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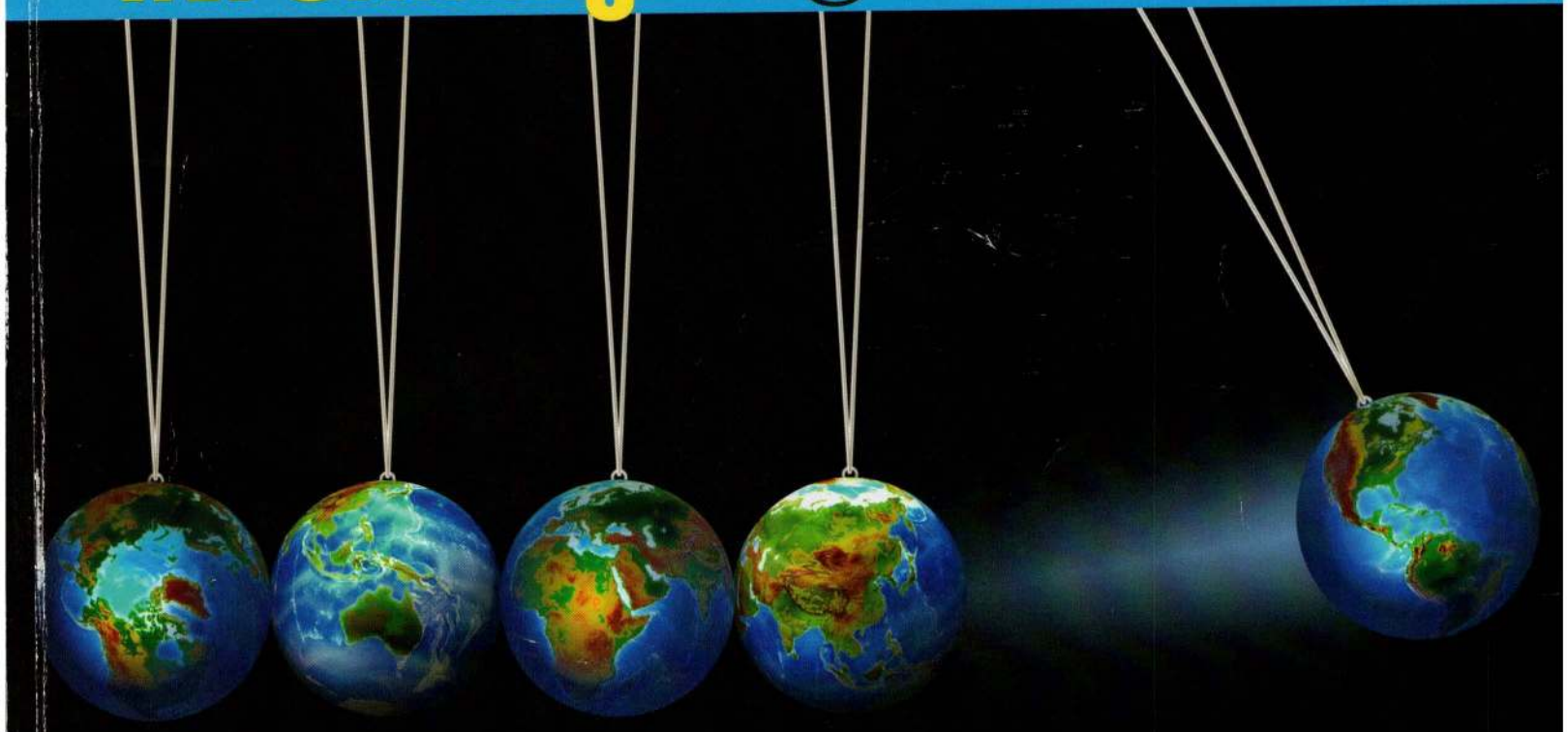

INFORMS Annual Meeting
San Diego 2009
October 11-14, 2009

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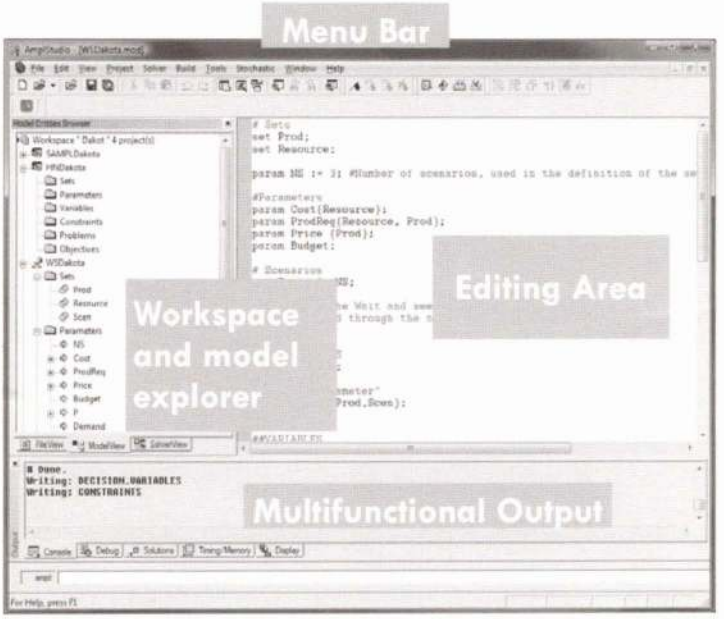
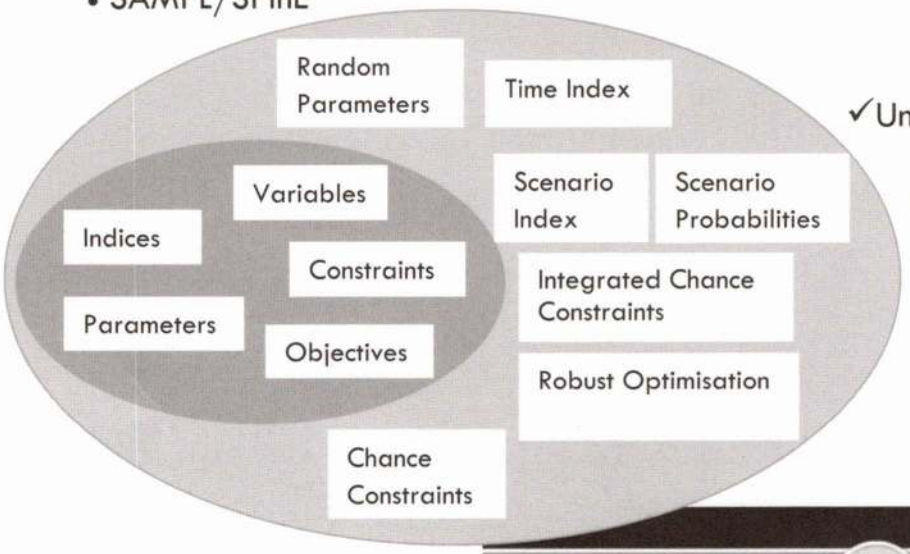
- FortMP (S-Plus/R environments)



✓**Stochastic Extensions**
- SAMPL/SPInE



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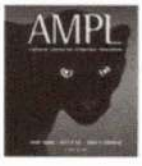

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Copies of papers abstracted in the meeting program are available only from the authors. Requests for papers should be sent to the authors at the addresses shown in the program. Published annually prior to the meeting by the Institute for Operations Research and the Management Sciences. Individual issues of the program are available for $20US per copy. Orders must be prepaid and sent to INFORMS, PO Box 632820, Baltimore, MD 21263.

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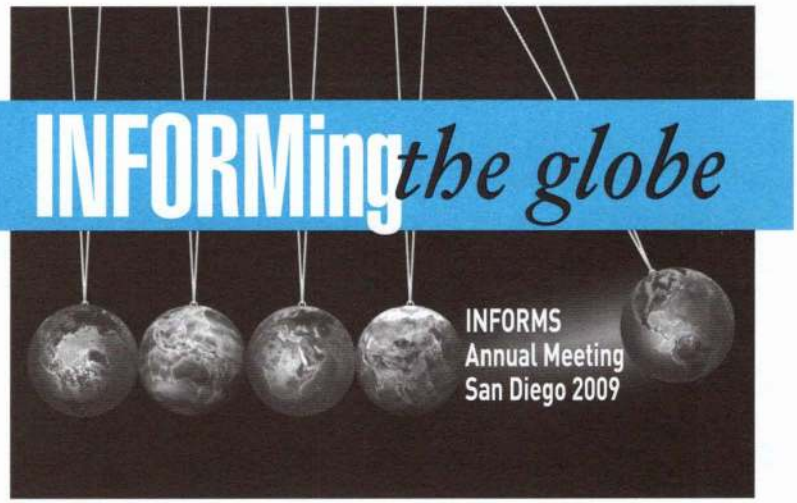

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WELCOME *from the General Chair*

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Dear Friends of Operations Research and Management Science,

It is with great pleasure that I welcome you to beautiful sunny San Diego, the finest city in America.

This year's conference truly reflects the many faces of San Diego. Also known as Silicon Beach, San Diego is home to one of the most concentrated computer and telecommunication industry clusters in the country. The bio-tech industry in and around San Diego is second to none – and it was here in San Diego 51 years ago, that global warming was first discussed. As the gateway to the Pacific Rim and with one-third of the US Naval Pacific fleet based here, San Diego has become a truly international destination.

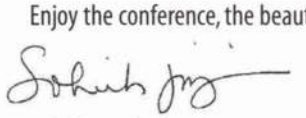
Our plenary and keynote speakers, as well the entire program, are deeply embedded in this rich background. Two highly successful company founders and scientists will address challenges and trends in the biotech and telecommunication industries. Speakers from GE, HP, MIT, Stanford and UCLA will address challenges as diverse as global education initiatives, energy efficient power distribution, socially and environmentally responsible supply chains, and climate policy models.

We are pleased to see an increased focus of operations research on environmental concerns and, as members of the Organizing Committee, we have tried to make INFORMS a bit greener. Conceivably you might have already contributed to this effort by opting out of having a printed program and you might notice that your name tags and program bags are made from recycled materials. We realize that these are small steps but hope that more creative minds will build on them in the future.

I would like to thank the Organizing Committee members for their efforts. But special thanks goes to Mohammad Oskoorouchi who as the Program Co-Chair has put an amazing program together; moreover, Mohammad in his additional role as Tutorials Chair, was able to invite 22 highly accomplished scholars and thought leaders in the field as tutorial speakers for the conference. Thomas Roemer, the Invited Sessions Chair, was instrumental in inviting the exemplary group of plenary and keynote speakers. The other members of the Organizing Committee who also were instrumental in organizing this conference were: Carlton Scott, Fred Raafat, Jeff Guyse, Abdullah Dasci, Fang Fang, Erica Klampfl, Robert Aboolian, and Ishpal Rekhi. It was also a privilege and pleasure for me to work with the INFORMS staff; they are a very professional, efficient, effective, organized and friendly group of people to work with. Finally, special thanks go to our sponsors, who even in these hard economic times were generous enough to support us in this endeavor. Our leadership sponsors are IBM and Microsoft Solver Foundation and our corporate and academic sponsors include AIMMS, California State University San Marcos, San Diego State University, the Rady School of Management at UCSD, and the University of Texas at Dallas.

A great time is assured to all: an informative conference, a delightful climate, a new hotel in the downtown with proximity to many of the attractions that San Diego has to offer. The general reception will be held at the world famous SeaWorld with a private evening at the Shamu show. There are also plant tours of two manufacturing facilities.

Enjoy the conference, the beautiful city of San Diego and its environs, and STAY GREEN!



Soheila Jorjani

PROGRAM *at a Glance*

NOTE:
Technical sessions are held at the San Diego Convention Center and Hilton San Diego Bayfront. Check the Master Track Schedule on pages 46-53 for specific room locations.

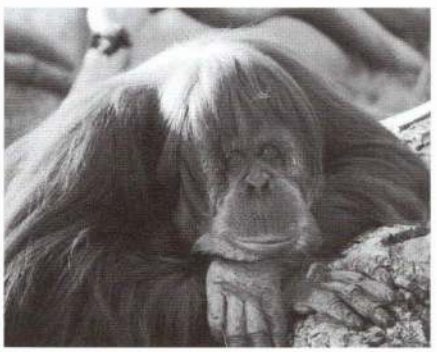
KEY
H-Hilton
C-Convention Center

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2009 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 46-53.



FRIDAY, OCTOBER 9

7:30am-5:00pm	Teaching Effectiveness Colloquium	H – 314, 3rd Fl.
6:00pm-8:00pm	Combined Colloquia	H – 306, 3rd Fl.

SATURDAY, OCTOBER 10

7:30am-4:30pm	Future Academician Colloquium	H – Sapphire I, 4th Fl.
7:30am-4:30pm	Future Practitioner Colloquium	H – Sapphire B, 4th Fl.
7:30am-4:30pm	Teaching Effectiveness Colloquium	H – 400, 4th Fl.
8:00am-5:00pm	DM-SI Workshop	H – Sapphire C, 4th Fl.
8:00am-5:15pm	CIST Conference	H – 206 & Indigo B, 2nd Fl.
9:00am-5:30pm	Vendor (Exhibitor) Workshops	H – See p. 20
4:00pm-7:00pm	Registration Opens	C – Hall H Foyer
5:00pm-6:00pm	INFORMS Membership Meeting	H – Sapphire A, 4th Fl.

SUNDAY, OCTOBER 11

7:00am-5:00pm	Registration	C – Hall H Foyer
8:00am-9:30am	Technical Sessions (SA)	Convention Center & Hilton
8:00am-4:30pm	CIST Conference	H – 206 & Indigo B, 2nd Fl.
9:30am-10:00am	Coffee Break	C – Room 25 Foyer
		H – Sapphire West Foyer, 4th Fl.
10:00am-10:50am	Welcome/Plenary Omega Rho: Hau Lee	H – Sapphire I, 4th Fl.
11:00am-12:30pm	Technical Sessions (SB)	Convention Center & Hilton
12:00pm-5:00pm	Exhibits, Job Fair, Free Internet Access	C – Exhibit Hall H
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Convention Center & Hilton
3:10pm-4:00pm	Keynote: Charles Cantor	H – Sapphire I, 4th Fl.
3:10pm-4:00pm	Keynote: Richard Larson	H – Sapphire M, 4th Fl.
4:00pm-4:30pm	Coffee Break	C – Exhibit Hall H
		H – Sapphire West Foyer, 4th Fl.
4:30pm-6:00pm	Technical Sessions (SD)	Convention Center & Hilton
6:15pm-7:15pm	INFORMS Community Business Meetings	See p. 11
7:30pm-9:00pm	Welcome Reception-Exhibits Open	C – Exhibit Hall H
8:30pm-9:45pm	Awards Ceremony & Dessert Reception	C – Room 28

MONDAY, OCTOBER 12

7:00am-5:00pm	Registration	C – Hall H Foyer
8:00am-9:30am	Technical Sessions (MA)	Convention Center & Hilton
9:00am-5:00pm	Exhibits, Job Placement, Free Internet Access	C – Exhibit Hall H
9:30am-10:00am	Coffee Break	C – Exhibit Hall H
		H – Sapphire West Foyer, 4th Fl.
10:00am-10:50am	Plenary: Mark Little	H – Sapphire I, 4th Fl.
11:00am-12:30pm	Technical Sessions (MB)	Convention Center & Hilton
12:30pm-1:30pm	Interactive Session	C – Exhibit Hall H
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (MC)	Convention Center & Hilton
3:10pm-4:00pm	Keynote: Edelman Reprise	H – Sapphire I, 4th Fl.
3:10pm-4:00pm	Keynote: Christopher Tang	H – Sapphire M, 4th Fl.
4:00pm-4:30pm	Coffee Break	C – Exhibit Hall H
		H – Sapphire West Foyer, 4th Fl.
4:30pm-6:00pm	Technical Sessions (MD)	Convention Center & Hilton
6:15pm-7:15pm	INFORMS Community Business Meetings	See p. 11

TUESDAY, OCTOBER 13

7:00am-5:00pm	Registration	C – Hall H Foyer
8:00am-9:30am	Technical Sessions (TA)	Convention Center & Hilton
9:00am-5:00pm	Exhibits, Job Placement, Free Internet Access	C – Exhibit Hall H
9:30am-10:00am	Coffee Break	C – Exhibit Hall H H – Sapphire West Foyer, 4th Fl.
10:00am-10:50am	Plenary: Irwin Jacobs	H – Sapphire I, 4th Fl.
11:00am-12:30pm	Technical Sessions (TB)	Convention Center & Hilton
12:30pm-1:30pm	Interactive Session	C – Exhibit Hall H
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (TC)	Convention Center & Hilton
3:10pm-4:00pm	Keynote: Thomas Magnanti	H – Sapphire I, 4th Fl.
3:10pm-4:00pm	Keynote: John Sterman	H – Sapphire M, 4th Fl.
4:00pm-4:30pm	Coffee Break	C – Exhibit Hall H H – Sapphire West Foyer, 4th Fl.
4:30pm-6:00pm	Technical Sessions (TD)	Convention Center & Hilton
6:15pm-7:15pm	Subdivision Business Meetings	See p. 11
7:00pm-9:30pm	General Reception Buses depart beginning at 6:30pm – see p. 17.	SeaWorld

WEDNESDAY, OCTOBER 14

7:00am-5:00pm	Registration	C – Hall H Foyer
8:00am-9:30am	Technical Sessions (WA)	Convention Center & Hilton
9:00am-1:00pm	Exhibits	C – Exhibit Hall H
9:00am-3:00pm	Job Placement, Free Internet Access	C – Exhibit Hall H
9:30am-10:00am	Coffee Break	C – Exhibit Hall H H – Sapphire West Foyer, 4th Fl.
10:00am-10:50am	Plenary: Yossi Sheffi	H – Sapphire I, 4th Fl.
11:00am-12:30pm	Technical Sessions (WB)	Convention Center & Hilton
12:45pm-2:15pm	Technical Sessions (WC)	Convention Center & Hilton
2:15pm-2:45pm	Coffee Break	C – Room 25 Foyer H – Sapphire West Foyer, 4th Fl.
2:45pm-4:15pm	Technical Sessions (WD)	Convention Center & Hilton
4:30pm-6:00pm	Technical Sessions (WE)	Convention Center & Hilton

ANNUAL MEETING ENEWS DAILY

INFORMS is publishing the second volume of Annual Meeting eNews Daily during the San Diego meeting. Each morning of the meeting, registrants will receive in their inboxes a preview of the day's key events and a recap of the previous day's happenings. Don't miss feature articles, session change information, previews of can't-miss events, photos, reminders and more.

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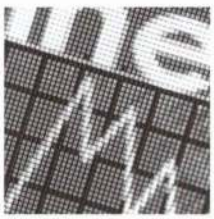

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SCHEDULE *of Special Events*

FRIDAY, OCTOBER 9	LOCATION	TIME
Teaching Effectiveness Colloquium	H - Room 314, 3rd Fl.	7:30am-5:00pm
Combined Colloquium	H - Room 306, 3rd Fl.	6:00pm-8:00pm

SATURDAY, OCTOBER 10		
Combined Colloquia		
Breakfast	H - Sapphire E, 4th Fl.	7:30am-8:00am
Future Academician Colloquium	H - Sapphire I, 4th Fl.	8:00am-4:30pm
Future Practitioner Colloquium	H - Sapphire B, 4th Fl.	8:00am-4:30pm
Teaching Effectiveness Colloquium	H - 400, 4th Fl.	8:00am-4:30pm
Colloquia Dinner	Off-Site, Bondi's Restaurant	7:00pm-9:00pm
Meetings Committee	H - Suite 2801	7:30am-12:00pm
DM-SI Workshop Breakfast/Welcome	H - Sapphire H, 4th Fl.	8:00am-8:30am
DM-SI Workshop	H - Sapphire D, 4th Fl.	8:00am-5:00pm
CIST Conference	H - Indigo B & 206, 2nd Fl.	8:00am-5:00pm
ISR Editors	H - 202A, 2nd Fl.	8:30am-3:00pm
Organization Science Competition	H - 204A, 2nd Fl.	8:30am-5:00pm
INFORMS Executive Committee	H - Aqua Boardroom, 3rd Fl.	9:00am-11:30am
Vendor Workshops – Session I		
AIMMS (Paragon)	H - 303, 3rd Fl	9:00am-11:30am
American Optimal Decisions	H - 304. 3rd Fl.	9:00am-11:30am
Maximal Software	H - 305, 3rd Fl.	9:00am-11:30am
SAS Global Academic Program	H - 306B, 3rd Fl.	9:00am-11:30am
Vendor Workshops – Session II		
FICO	H - 304, 3rd Fl.	12:00pm-2:30pm
Gurobi Optimization	H - 306A, 3rd Fl.	12:00pm-2:30pm
JMP	H - 306B, 3rd Fl.	12:00pm-2:30pm
Salford Systems	H - 305, 3rd Fl.	12:00pm-2:30pm
INFORMS Board Meeting	H - Indigo D, 2nd Fl.	12:00pm-5:00pm
Vendor Workshops – Session III		
Frontline Systems	H - 305, 3rd Fl.	3:00pm-5:30pm
GAMS Development Corp.	H - 306A, 3rd Fl.	3:00pm-5:30pm
IBM-ILOG	H - 304, 3rd Fl.	3:00pm-5:30pm
Imagine That	H - 302, 3rd Fl.	3:00pm-5:30pm
LINDO Systems	H - 303, 3rd Fl.	3:00pm-5:30pm
Responsive Learning Technologies	H - 300, 3rd Fl.	3:00pm-5:30pm
SAS	H - 306B, 3rd Fl.	3:00pm-5:30pm
INFORMS Membership Meeting/Reception	H - Sapphire A, 4th Fl.	5:00pm-6:00pm
Roundtable Reception & Dinner	H - Indigo E & A, 2nd Fl.	5:00pm-8:30pm
ISR Senior & Associate Editors	H - 202A, 2nd Fl.	6:00pm-7:30pm
University of Texas at Dallas Reception	H - 204B, 2nd Fl.	6:00pm-9:00pm

KEY
H-Hilton
C-Convention Center

For INFORMS Community business meetings, see page 11.

WIN *a Kindle*

Visit the exhibits and get in the running to win a Kindle! INFORMS will award two Kindles during the afternoon coffee breaks in the Exhibit Hall. Just follow these easy steps:

- Stop by one of the booths to pick up a raffle coupon (different 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 Kindle Raffle bin.
- You must be present to win.

Schedule:

- Sunday, Monday and Tuesday afternoon coffee breaks.
- Submit your coupon by 3:45pm.
- Drawing: 4:15pm. Location in the Exhibit Hall will be announced.

Note: there is a different coupon for each day. Only coupons for that day will be eligible.

You must be present to win.

SCHEDULE *of Special Events*

SUNDAY, OCTOBER 11

New Member Breakfast	H - Indigo G, 2nd Fl.	7:00am-8:00am
Roundtable Meeting	H - Indigo A, 2nd Fl.	7:00am-5:00pm
JPS Breakfast	H - Indigo C, 2nd Fl.	7:30am-9:00am
Guest Breakfast	H - Elevation Room, 30th Fl.	8:00am-9:00am
INFORMS Board	H - Indigo D, 2nd Fl.	8:00am-3:30pm
CIST Conference	H - Indigo B & 206, 2nd Fl.	8:00am-5:00pm
Plenary-Omega Rho: Hau Lee	H - Sapphire I, 4th Fl.	10:00am-10:50am
Combined Colloquia Committee	H - 204B, 2nd Fl.	10:00am-11:00am
CIEADH	H - 204A, 2nd Fl.	10:00am-5:00pm
Omega Rho Lunch/Meeting	H - 202B, 2nd Fl.	11:00am-1:00pm
Junior Faculty Interest Group Lunch	H - Indigo G, 2nd Fl.	11:30am-1:00pm
OR Editors Lunch/Meeting	H - Aqua Boardroom, 3rd Fl.	12:00pm-2:00pm
Keynote-Richard Larson	H - Sapphire M, 4th Fl.	3:10pm-4:00pm
Keynote-Charles Cantor	H - Sapphire I, 4th Fl.	3:10pm-4:00pm
Chapters/Fora Committee	H - 202B, 2nd Fl.	3:30pm-4:30pm
Section/Societies Committee	H - 204B, 2nd Fl.	3:30pm-4:30pm
Roundtable/INFORMS Board	H - Indigo A, 2nd Fl.	4:30pm-5:30pm
President's Reception Roundtable	H - Indigo E, 2nd Fl.	5:30pm-6:30pm
IOL Launch Party	H - 206, 2nd Fl.	6:00pm-7:00pm
ISI-IEOR (Iranians in OR)	H - 303, 2nd Fl.	6:15pm-7:15pm
Welcome Reception-Exhibits Open	C - Exhibit Hall H	7:30pm-9:00pm
Chapter Meet-and-Greet	C - Exhibit Hall H	7:30pm-9:00pm
Minority Issues Forum Reception	H - Indigo C, 2nd Fl.	8:00pm-9:00pm
Awards Ceremony & Dessert Reception	C - Room 28	8:30pm-9:45pm

MONDAY, OCTOBER 12

Board/Editors/Committee Chair Breakfast	H - 204B, 2nd Fl.	7:00am-8:00am
ACORD Breakfast/Meeting	H - 204A, 2nd Fl.	7:30am-9:00am
Guest Breakfast	H - Elevation Room, 30th Fl.	8:00am-9:00am
Korea Chapter Breakfast	H - Indigo B, 2nd Fl.	8:00am-9:30am
San Diego Area Math Teacher Workshop	Off-Site	8:00am-5:00pm
Strategic Planning Committee	H - Aqua Boardroom, 3rd Fl.	8:15am-10:00am
Continuing Education Committee	H - 206, 2nd Fl.	9:00am-10:00am
Subdivisions Council	H - 202B, 2nd Fl.	9:00am-11:30am
Decision Analysis Editors	H - 204B, 2nd Fl.	9:30am-11:00am
Plenary-Mark Little	H - Sapphire I, 4th Fl.	10:00am-10:50am
Education Committee	H - 206, 2nd Fl.	10:00am-11:00am
New Member Focus Group	H - 206, 2nd Fl.	11:00am-12:30pm
COIN-OR Members & Users	C - 25A	12:15pm-1:15pm
Publications/Editors in Chief	H - Indigo C, 2nd Fl.	12:30pm-3:30pm
Service Science PhD Consortium	H - 402, 4th Fl.	12:30pm-1:30pm
Fellows Luncheon	H - Indigo D, 2nd Fl.	12:45pm-2:30pm
Keynote-Edelman Reprise	H - Sapphire I, 4th Fl.	3:10pm-4:00pm
Keynote-Christopher S. Tang	H - Sapphire M, 4th Fl.	3:10pm-4:00pm
Isolated Academics	H - 206, 2nd Fl.	3:15pm-4:15pm
CPMS Isolated Practitioners Workshop	C - 31B	6:15pm-7:15pm
Interfaces Editors	H - Sapphire Boardroom, 4th Fl.	6:15pm-7:15pm
University of Florida ISE Reception	H - 204A, 2nd Fl.	6:30pm-7:30pm
University of Michigan Reception	Off-Site, Rock Bottom Brewery	6:30pm-9:00pm
Northwestern University Reception	H - 204B, 2nd Fl.	7:00pm-8:30pm
Texas A&M University Reception	H - 202B, 2nd Fl.	7:00pm-8:30pm
Harvard Business School Reception	H - 304, 3rd Fl.	7:00pm-9:00pm
Military Applications Reception	C - 30D	7:15pm-9:15pm
University of North Carolina Reception	H - 206, 2nd Fl.	7:30pm-9:00pm
Wharton School Reception	H - 310, 3rd Fl.	7:30pm-9:00pm
Student Reception	H - Indigo G, 2nd Fl.	7:30pm-9:00pm

SCHEDULE *of Special Events*

TUESDAY, OCTOBER 13

Chapters/Fora Officers Breakfast	H - Indigo D, 2nd Fl.	7:00am-8:00am
CPMS Council Meeting	H - Indigo B, 2nd Fl.	7:00am-8:30am
Transportation Science Editors	H - Sapphire Boardroom, 4th Fl.	7:30am-9:00am
Student Chapter Officers	H - Indigo D, 2nd Fl.	8:00am-8:45am
Guest Breakfast	H - Elevation Room, 30th Fl.	8:00am-9:00am
Meetings Committee	H - Suite 2801	8:30am-5:00pm
Plenary-Irwin Jacobs	H - Sapphire I, 4th Fl.	10:00am-10:50am
Sections/Societies Officers Lunch	H - Indigo E, 2nd Fl.	12:00pm-1:30pm
JOC Editors Meeting/Lunch	H - Elevation Room, 30th Fl.	12:30pm-1:30pm
Women in OR/MS Meeting/Lunch	H - Indigo G, 2nd Fl.	12:30pm-1:30pm
Keynote-Tom Magnanti	H - Sapphire I, 4th Fl.	3:10pm-4:00pm
Keynote-John Sterman	H - Sapphire M, 4th Fl.	3:10pm-4:00pm
Future Organizing Committee Reception	H - Elevation Room, 30th Fl.	5:00pm-6:00pm
IFORS 2011 Committee	H - 202A, 2nd Fl.	6:15pm-7:15pm
General Reception	SeaWorld	7:30pm-9:30pm
	Busses depart beginning at 6:30pm – see p.17.	

WEDNESDAY, OCTOBER 14

Plenary-Yossi Sheffi	H - Sapphire I, 4th Fl.	10:00am-10:50am

H1N1 FLU UPDATE

We recognize that some people traveling to the INFORMS meeting have concerns about the H1N1 flu. Both the World Health Organization and U.S. Centers for Disease Control have confirmed that they do *not* recommend travel restrictions related to the virus. We encourage all attendees to use common-sense precautions to protect both yourself and those around you:

- Wash your hands frequently with soap and water. Alcohol-based hand cleaners are also effective and can be purchased at any drug store. There will be convenient Purrell Hand Sanitizing Stations available at the San Diego Convention Center and Hilton.
- If you sneeze or cough, use a tissue to cover your mouth; then safely discard the tissue and wash your hands.
- If you feel ill, with a fever and flu-like symptoms, please inform the INFORMS meeting organizers that you are ill so we can assist you if needed. Contact the INFORMS Registration Desk at: 619.525.6333.

GOING GREEN

INFORMS is committed to making the Annual Meeting environmentally friendly. This year, we have partnered with the San Diego Convention Center and the Hilton Bayfront to conserve energy, use sustainable practices, recycle, reuse and reduce as much as possible. We encourage meeting attendees to join in this effort by being aware of all these opportunities to minimize our mutual carbon footprint.

Printed Program. Approximately 38% 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 San Diego. Reference copies of the printed program will be available at all Session Monitor desks and Program Information booths (see maps on pages 44-45 for locations). In addition, all attendees received the Quick Reference, which summarizes the technical session schedule, special events and community business meeting listings, and maps of the Center and Hotel.

Sustainable Registration Materials. Both the conference bag and badge holder are made from recycled materials. We hope you will reuse the conference bag for your grocery shopping 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.

Recycling Daily. Both the Center and the Hilton provide clearly marked bins for recyclables. Mixed recyclables (paper, plastic, aluminum, glass) are collected daily.

Recycling at End of the Meeting. In addition to the normal recycling bins, INFORMS will provide special bins at the Registration Desk where you can deposit your printed program, badge holder and bag, if you prefer not to take them home for reuse.

Donations to Local Nonprofit Organizations. Working with the San Diego Convention Center, INFORMS will donate any usable materials to a local nonprofit organization. This includes extra food left over after events. The San Diego Convention Center has received multiple awards for its conservation and recycling programs. The Center infrastructure has been upgraded to efficient energy standards, including systems for heating/cooling, lighting and dishwashing. Low-flow automatic sinks and toilets are in all restrooms. Outdoor landscaping uses drip irrigation, drought-tolerant plants and mulch to reduce watering. The Hilton Bayfront has instituted many of the same efficiency and sustainability improvements.

Recycle & Reuse Registration Materials

If you don't want to take your program book, bag and badge holder home, deposit them at the end of the meeting in special bins at the INFORMS Registration Desk. Useable items will be donated to a local nonprofit organization; paper products will be recycled.

Opted Not to Receive the Printed Program?

Thank you for going green! If you need to quickly reference the printed program book, reference copies will be available at all Session Monitor desks and Program Information booths. See maps on pages 44-45 for locations.

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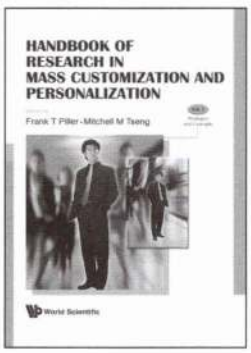

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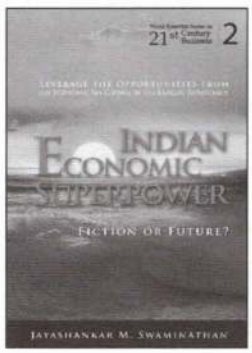

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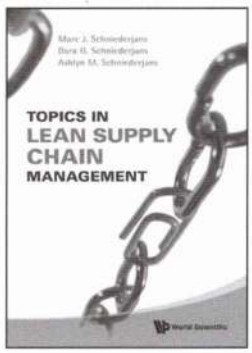

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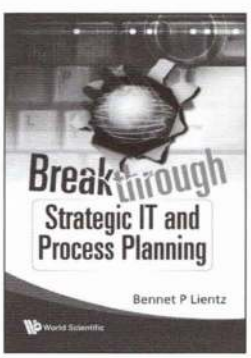

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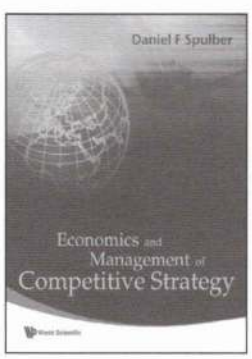

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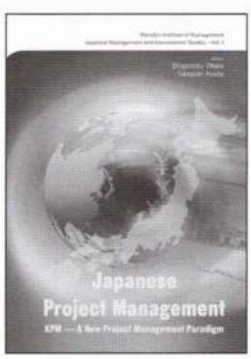

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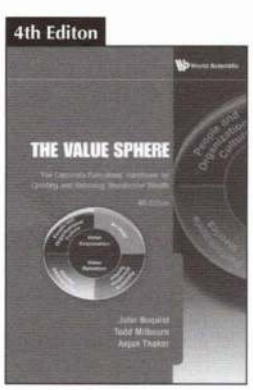

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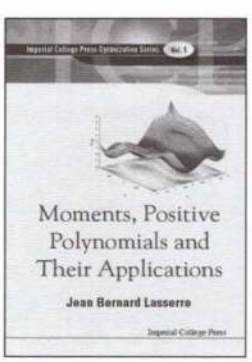

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INFORMS *Community Business Meetings*

SUNDAY, OCTOBER 11

Aviation Applications	C - 31A	6:15pm-7:15pm
Data Mining & Artificial Intelligence	C - 24C	6:15pm-7:15pm
eBusiness	C - 26B	6:15pm-7:15pm
Energy, Natural Resources & Environment	H - 505, 5th Fl.	6:15pm-7:15pm
Forum on Education (INFORM-ED)	H - 202A, 2nd Fl.	6:15pm-7:15pm
Information Systems	H - Indigo B, 2nd Fl.	6:15pm-7:15pm
Location Analysis	H - 312, 3rd Fl.	6:15pm-7:15pm
Military Applications Board	C - 30D	6:15pm-7:15pm
Minority Issues Forum	H - 500, 5th Fl.	6:15pm-7:15pm
Optimization	H - 310, 3rd Fl	6:15pm-7:15pm
Railway Applications	C - 32A	6:15pm-7:15pm
Revenue Management & Pricing	H - 503, 5th Fl.	6:15pm-7:15pm
Service Science	H - 402, 4th Fl.	6:15pm-7:15pm
Simulation	C - 31C	6:15pm-7:15pm
Section on Public Programs, Services & Needs	H - Sapphire K, 4th Fl.	6:15pm-7:15pm
Telecommunications	C - 27A	6:15pm-7:15pm
Transportation Science & Logistics Board	C - 30B	6:15pm-7:15pm
Women in OR/MS	H - 411, 4th Fl.	6:15pm-7:15pm
Decision Analysis Council	H - 204B, 2nd Fl.	6:15pm-7:30pm
Revenue Management & Pricing Board	H - 503, 5th Fl.	7:15pm-8:15pm

MONDAY, OCTOBER 12

Decision Analysis	C - 22	6:00pm-7:15pm
Technology Management	H - 411, 4th Fl.	6:00pm-7:15pm
Applied Probability	C - 25A	6:15pm-7:15pm
Computing	C - 26A	6:15pm-7:15pm
CPMS Isolated Practitioners Workshop	C - 31B	6:15pm-7:15pm
Financial Services	H - Sapphire G, 4th Fl.	6:15pm-7:15pm
Health Applications	H - Sapphire A, 4th Fl.	6:15pm-7:15pm
Manufacturing & Service Operations Mgt.	H - Sapphire I, 4th Fl.	6:15pm-7:15pm
Military Applications	C - 30D	6:15pm-7:15pm
Quality, Statistics & Reliability	C - 24B	6:15pm-7:15pm
Spreadsheet Productivity Research	H - 412, 4th Fl.	6:15pm-7:15pm
Transportation Science & Logistics	H - Indigo A, 4th Fl.	6:15pm-7:15pm
Behavioral Operations Management	H - 313, 3rd Fl.	7:15pm-8:15pm

TUESDAY, OCTOBER 13

CPMS Council	H - Indigo B, 2nd Fl.	7:00am-8:30am
Women in OR/MS Meeting/Lunch	H - Indigo G, 2nd Fl.	12:30pm-1:30pm
SpORts	H - 300, 3rd Fl.	6:00pm-7:00pm

KEY
H-Hilton
C-Convention Center

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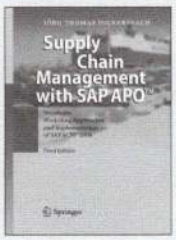


Supply Chain Management with SAP APO™

3RD EDITION

Structures, Modelling Approaches and Implementation of SAP SCM™ 2008

J. T. Dickersbach, Munich, Germany

This book addresses the question of how to implement APO (Advanced Planner and Optimiser software) in a company.
The software from SAP is dedicated to supply chain management. It is written from a long years' experience in implementation projects. The focus is on introducing modeling approaches and explaining the structure and interdependencies of systems, modules and entities of APO. Another concern is the integration with the R/3 system(s), both technically and from a process point of view. Since APO projects differ significantly from other SAP projects, some key issues and common mistakes concerning project management are covered.

3rd ed. 2009. XVI, 504 p. Hardcover
ISBN 978-3-540-92941-3 ► **$89.95**

Dynamic Optimization and Differential Games

T. L. Friesz, Pennsylvania State University, University Park, PA, USA

This book has been written to address the increasing number of Operations Research and Management Science problems (that is, applications) that involve the explicit consideration of time and of gaming among multiple agents. It is a book that will be used both as a textbook and as a reference and guide by those whose work involves the theoretical aspects of dynamic optimization and differential games.

2010. Approx. 535 p. 71 illus. (International Series in Operations Research & Management Science, Volume 135) Hardcover
ISBN 978-0-387-72777-6 ► **approx. $219.00**

Continuous-Time Markov Decision Processes

Theory and Applications

X. Guo, Zhongshan University, Guangzhou, Peoples Republic of China; **O. Hernández-Lerma**, Instituto Politécnico Nacional, Mexico

This volume provides a unified, systematic, self-contained presentation of recent developments on the theory and applications of continuous-time MDPs. The MDPs in this volume include most of the cases that arise in applications, because they allow unbounded transition and reward/cost rates. Much of the material appears for the first time in book form.

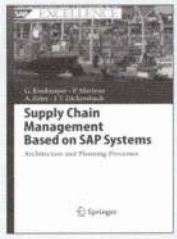
2009. Approx. 300 p. (Stochastic Modelling and Applied Probability, Volume 62) Hardcover
ISBN 978-3-642-02546-4 ► **$99.00**

Mathematical Optimization and Economic Analysis

M. Luptácik, Vienna University of Economics and Business Administration, Department of Economics

This monograph is a self-contained introduction to the optimization techniques used in economic modeling such as mathematical programming and data envelopment analysis. It demonstrates the usefulness of these mathematical tools in quantitative and qualitative economic analysis. The book presents specific examples to demonstrate each technique's advantages and applicability as well as numerous applications of these techniques to industrial economics, regulatory economics, trade policy, economic sustainability, production planning, and environmental policy.

2010. XIV, 292 p. 53 illus. (Springer Optimization and Its Applications, Volume 36) Hardcover
ISBN 978-0-387-89551-2 ► **$99.00**



Supply Chain Management Based on SAP Systems

Architecture and Planning Processes

G. F. Knolmayer, University of Bern, Switzerland; **P. Mertens**, Universität Erlangen-Nürnberg, Nürnberg, Germany; **A. Zeier**, University of Potsdam, Germany; **J. T. Dickersbach**, Munich, Germany

Since SAP is emphasizing recent developments in operations management in its SCM initiative, this book describes the methodological background from the viewpoint of a company using SAP systems. It describes order processing both in an intra- and interorganizational perspective, as well as future developments and system enhancements.

2009. XI, 207 p. 77 illus. (SAP Excellence) Hardcover
ISBN 978-3-540-68737-5 ► **$69.95**

Optimization for Decision Making

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K. G. Murty, University of Michigan, Ann Arbor, MI, USA

While maintaining the rigorous LP instruction required, Murty's new book is unique in his focus on developing modeling skills to support valid decision making for complex real world problems. He describes the approach as ‚intelligent modeling and decision making' to emphasize the importance of employing the best expression of actual problems and then applying the most computationally effective and efficient solution technique for that model.

2010. XXIII, 670 p. 47 illus. (International Series in Operations Research & Management Science, Volume 137) Hardcover
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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 stick as a back-up.

Speaker Ready Room

There will be a Speaker Ready Room available in the Convention Center, Exhibit Hall H, 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 Desks

If you have general questions about the meeting and/or questions about your own presentation, stop by one of the Program Information Desks. Desks are located in the Convention Center (next to INFORMS Registration) and the Hilton (Sapphire West foyer, 4th floor). 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 both the Convention Center and Hilton (see maps on pages 44-45 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.

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).

EXHIBITS

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

Sunday, Oct. 11	12:00pm-5:00pm
	7:30pm-9:00pm*
	(Welcome Reception)
Monday, Oct. 12	9:00am-5:00pm
Tuesday, Oct. 13	9:00am-5:00pm
Wednesday, Oct. 14	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.

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AIMMS 3

FREE INTERNET AT CONVENTION CENTER

Free wireless Internet and an email center are located in the Convention Center, Exhibit Hall H, 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. 11	12:00pm-5:00pm
Monday, Oct. 12	9:00am-5:00pm
Tuesday, Oct. 13	9:00am-5:00pm
Wednesday, Oct. 14	9:00am-3:00pm

Hilton: there is no complimentary wireless available at the Hilton. Hotel guests can access the Internet for $13.95 for a 24-hour time frame.

BUSINESS CENTERS

Convention Center: a FedEx Kinko's is located in the Hall D lobby, ground level.
Hilton: a UPS Store is located on the 3rd floor, close to the escalators.

SPEAKER *Information*

REGISTRATION

Badges Required for Technical Sessions

INFORMS Annual Meeting 2009 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. Continental breakfasts on Sunday, Monday and Tuesday are also included (guest breakfasts are held in the Hilton, Elevation Room, 30th floor). 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 booth (#41-43 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

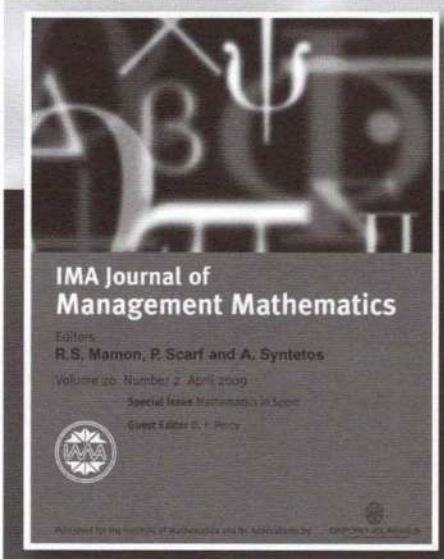
A luggage check area will be located in the Convention Center near the registration desk on Tuesday and Wednesday from 7:30am to 6:30pm.

San Diego Visitor Information

The Convention Center restaurant and Concierge Services, located outside Exhibit Hall E, provides restaurant reservations, discount coupons, tour tickets and MTS transit passes for sale, and arts and culture information. Stop by for information on what to see and do in San Diego. Hours of operation are 9:00am-6:00pm daily

IMA Journal of Management Mathematics

Edited by Professor Rogemar S Mamon, Professor Philip Scarf and Dr Aris A Syntetos



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GUEST PROGRAM & TOURS, *Plant Tours*

GUEST PROGRAM

The program for registered guests includes a continental breakfast on Sunday, Monday and Tuesday mornings; the Sunday Welcome Reception and Awards Ceremony; and 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 Breakfasts
Hilton-Elevation Room, 30th Floor
Sunday-Tuesday, 7:30am – 9:00am
Identify yourself as an INFORMS guest and present your ticket when you arrive at the restaurant. Tickets are included in your registration packet, and will be collected at the door for each breakfast.

GUEST TOURS

You may still be able to register for the following guest tours. Go to the INFORMS Registration Desk for information on availability. ***Meet in Hilton lobby for guest tour departures. Buses will leave at the beginning time listed for each tour, and will return to the Hilton at the ending time listed.***

Passport to Balboa Park Museums and Garden
Sunday, October 11
9:45am-1:15pm $64
Scenic Balboa Park is America's largest municipal park. Nestled above the downtown area and housing museums from two major world expositions, Balboa Park has given San Diego the largest collection of museums outside of the U.S. capital. In addition to the fine museums, Spanish architecture, sculptured fountains, street jugglers, mimes and musicians, there are splendid gardens and excellent restaurants. You will receive a "passport" to Balboa Park that allows one entrance to four of 13 participating museums and the Japanese Friendship Garden.

Roar and Explore at the San Diego Zoo
Monday, October 12
9:00am-12:30pm $64 (lunch not included)
The San Diego Zoo, known for its extensive collection of flora and fauna, is the world's foremost zoological facility. Explore the zoo and visit new and innovative exhibits. Recent additions and renovations to the zoo include: the Giant Panda Research Station, Gorilla Tropics, Hippo Beach, Polar Bear Plunge, Scripps Aviary, Tiger River and Sun Bear Forest. The tour includes a 35-minute guided bus tour, Skyfari aerial tram ride and uniformed tour guide staff assistance.

PLANT TOURS

You may still be able to register for the following plant tours. Go to the INFORMS Registration Desk for information on availability. Meet at the Hilton, Promenade East Lobby, ground level (from the lobby level, take the escalator down to the Promenade East Lobby). Buses will leave at the beginning time listed for each tour, and will return to the Hilton at the ending time listed.

General Dynamics NASSCO
Tuesday, October 13
8:40am-10:20am $35
General Dynamics NASSCO has been designing and building ships since 1959, specializing in auxiliary and support ships for the U.S. Navy and oil tankers and dry cargo carriers for commercial markets. Located in San Diego, NASSCO employs more than 4,700 people and is the only major ship construction yard on the West Coast of the United States. The tour of the facility will be carried out on the bus (no off-bus walking at the facility), guided by company employees, along with a company overview and opportunities for Q&A.

Solar Turbines
Wednesday, October 14
7:30am-11:30am $35
Solar Turbines is a world leading producer of mid-range industrial gas turbines for use in power generation, natural gas compression and pumping systems. It provides full product support, equipment supply, financing, plus installation and operation and maintenance capability. The visit will include an introduction and overview, 60-minute facility walking tour, and then a panel discussion (Q&A) over the specialty areas of their supply chain process, manufacturing process, product engineering, and quality process.

Requirements: Comfortable walking shoes, no open-toed shoes, no shorts.

SPECIAL *Receptions*

YOUR BADGE IS YOUR TICKET

Wear your badge for admission to these events; your meeting registration fee includes these 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, Tuesday General Reception and continental breakfasts on Sunday, Monday and Tuesday (breakfasts held at the Hilton Hotel, Elevation Room, 30th floor).

SUNDAY

WELCOME RECEPTION & EXHIBITS

7:30pm-9:00pm
Convention Center
Exhibit Hall H

INFORMS and the San Diego Organizing Committee welcome you to the 2009 Annual Meeting with an evening of fellowship and fun. The Welcome Reception is the perfect venue to meet with colleagues, visit the exhibits and enjoy some great food. Soft drinks and water are complimentary, with a cash bar available for other beverages.

INFORMS AWARDS CEREMONY & DESSERT RECEPTION

8:30pm-9:45pm
Convention Center
Room 28A-D, Upper Level

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 escalator up to the Upper Level 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.*

INFORMS Prize for the Teaching of OR/MS Practice Award
James K. Lowe, U.S. Air Force Academy

INFORMS Expository Writing Prize
Dimitri Bertsekas, Massachusetts Institute of Technology

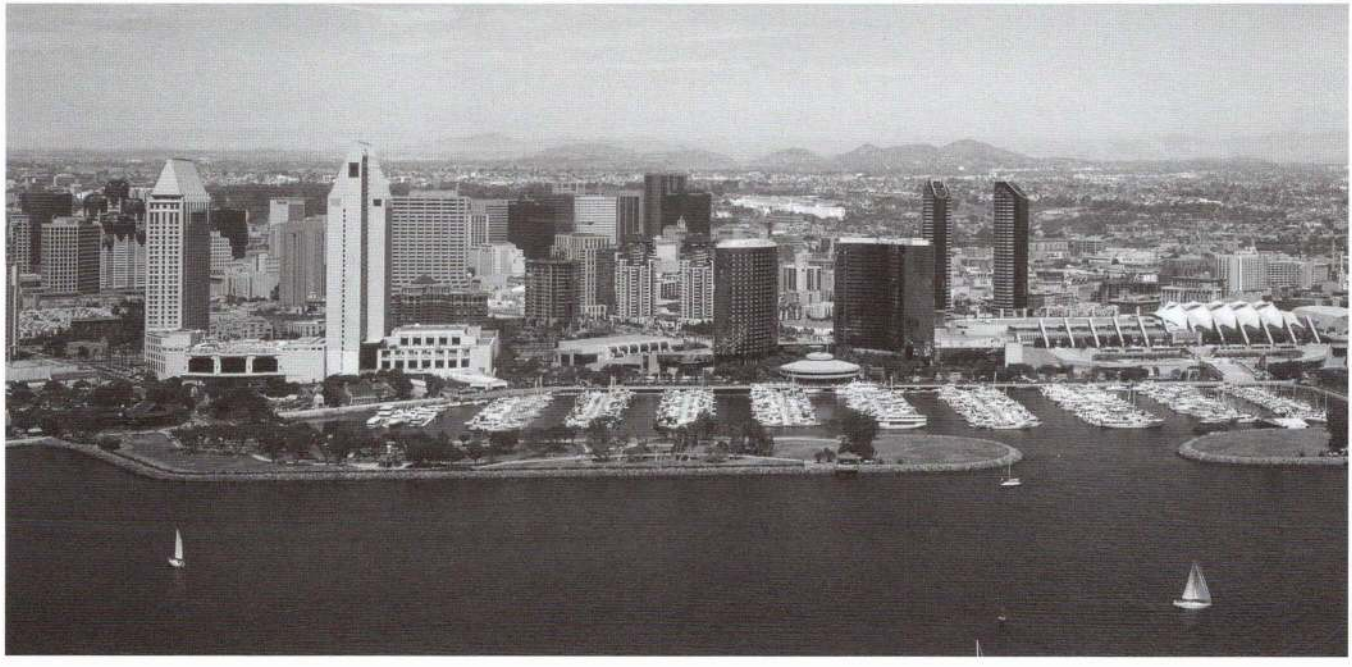
Philip McCord Morse Lectureship Award
Edward H. Kaplan, Yale University

John von Neumann Theory Prize
Yurii Nesterov, Catholic University of Louvain
Yinyu Ye, Stanford University

George E. Kimball Medal
Mark S. Daskin, Northwestern University
Michael A. Trick, Carnegie Mellon University

INFORMS President's Award
Ralph L. Keeney, Duke University

Three student paper awards will also be announced during the ceremony: the George E. Nicholson Student Paper Competition, the George B. Dantzig Dissertation Awards, and the Doing Good with Good O.R. Student Competition. In addition, the winners of the Bonder Scholarship for Applied Operations Research in Health Science and in Military Applications will be presented.



SATURDAY, OCTOBER 10

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Hilton – Sapphire A, 4th Floor
Come and see a demonstration of the newly redesigned INFORMS website at this annual membership meeting. Other current business and future directions for INFORMS are also on the agenda. The INFORMS Board of Directors encourages all members to bring their ideas, opinions and suggestions.

SUNDAY, OCTOBER 11

New Member Breakfast
7:00am-8:00am (Ticket Required)
Hilton – Indigo GH, 2nd Floor
The INFORMS Membership Committee will host this breakfast to welcome and orient people who are new to INFORMS. Representatives from several INFORMS communities will be on hand to provide information about their services. Continental breakfast will be served. New members received a ticket with their registration materials.

Sponsored by San Diego State University

SAN DIEGO STATE UNIVERSITY
College of Business Administration
Leadership for the Global Marketplace

IOL Launch Party
6:00pm-7:00pm
Hilton – Room 206, 2nd Floor
Come and see a demonstration of your new website. Slated to launch to the world in late November, the new IOL has been completely redesigned and re-architectured to serve both members and visitors better. Tell us what you think over refreshments and meet IOL Editor-in-Chief Mohan Sodhi.

Chapter Meet-and-Greet
7:30pm-9:00pm
Convention Center – Exhibit Hall H
It's a big meeting - make it personal and come introduce yourself to the members of your local INFORMS chapter! Various geographical chapters will host a table during the Welcome Reception. You're invited to stop by, have a drink, enjoy some refreshments, chat about chapter events and meet new friends in your area.

Minority Issues Forum Reception
8:00pm-9:00pm
Hilton – Indigo C, 2nd Floor
Come meet old friends and make new ones while talking about minority issues and other intellectual issues and opportunities.

Sponsored by Cornell University; North Carolina State University, Industrial & Systems Eng. Dept.; and Rice University, Dept. of Computational and Applied Math.

MONDAY, OCTOBER 12

COIN-OR Members & Users Meeting - Bag Lunch
12:15pm-1:15pm
Convention Center – 25A
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.

CPMS Isolated Practitioner Workshop & Reception
6:15pm-7:15pm
Convention Center – 31B
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. This 26th workshop will address timely issues that affect isolated practitioners. All are welcome to participate. Wine and cheese will be served.

Student Reception
7:30pm-9:00pm
Hilton – Indigo GH, 2nd Floor
All students registered for the meeting are encouraged to attend this special reception for an opportunity to socialize and network with other students.

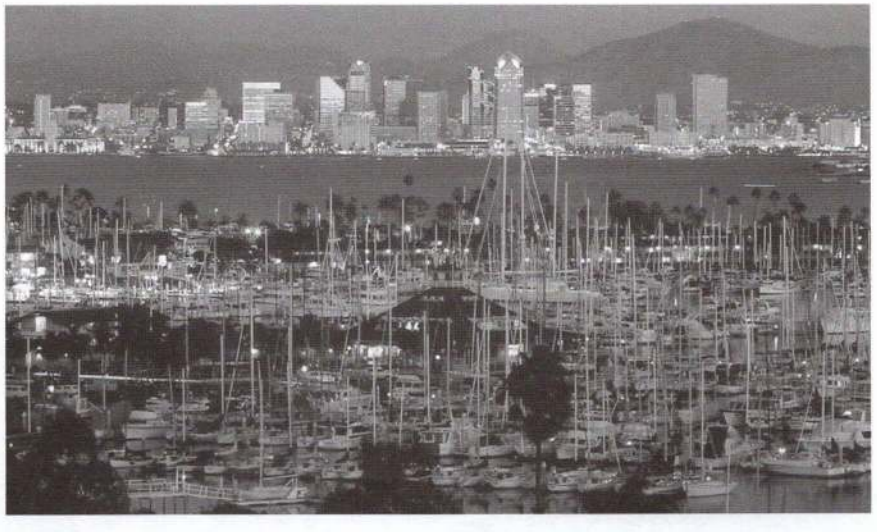
Sponsored by UC San Diego

Rady | UC San Diego School of Management

TUESDAY, OCTOBER 13

Women in OR/MS Forum Luncheon
12:30pm-1:30pm
Hilton – Indigo GH, 2nd Floor
$10 ($5 students) – *A limited number of tickets may be available on-site. Go to the INFORMS registration desk for information on availability.*
All those interested in issues related to women professionals in OR/MS are invited to join us.

Sponsored by: Raytheon Missile Systems; University of Massachusetts, College of Engineering; University of Massachusetts, School of Management; SAS; Northwestern University, Dept. of IMSE; University of Portland, Pamplin School of Business Administration; University of Texas-Arlington, Dept. of IMSE; Harlan Crowder Photography.



SATURDAY *Workshops*

All workshops are located in the Hilton.

DM-SI WORKSHOP

4th INFORMS Workshop on Data Mining and System Informatics

Breakfast/Welcome Session
8:00am-8:30am – Hilton, Sapphire H

Workshop
8:30am-5:00pm – Hilton, Sapphire C

The Data Mining (DM) and Artificial Intelligence (AI) sections of INFORMS are jointly organizing this workshop. The DM and AI 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 and AI. This DM-SI Workshop highlights the frontiers of fundamental and applied research in DM, AI and system informatics.

Sponsored by the INFORMS Section on Artificial Intelligence and the INFORMS Section on Data Mining.

VENDOR WORKSHOPS

9:00am - 11:30am

AIMMS® (Paragon) - Optimization in the Face of Uncertainty
Room 303

American Optimal Decisions - Portfolio Safeguard by AORDA
Room 304

Maximal Software - Opt. Modeling with MPL: New Features, New Trends and Free Software
Room 305

SAS Global Academic Program - Introduction to SAS Enterprise Miner
Room 306B

12:00pm - 2:30pm

FICO - Fast Track Opt. Modeling Using Xpress
Room 304

Gurobi Optimization - Version 2.0: the New Performance Leader in Linear and Mixed-Integer Programming
Room 306A

JMP - Exploration, Experimentation and Visualization with JMP
Room 306B

Salford Systems - Getting Started with Data Mining
Room 305

3:00pm - 5:30pm

Frontline Systems - Optimal Decisions for Uncertain Models
Room 305

GAMS - Modeling System and Productivity Tools
Room 306A

IBM® ILOG Optimization - Technical Forum
Room 310

Imagine That - Learn to Model with ExtendSim 7
Room 304

LINDO Systems - Solving Your Problems Quickly with LINGO and What's Best
Room 303

Responsive Learning Technologies - Online Games for Operations Mgt. and SC Courses
Room 300

SAS - Solving Business Optimization Problems with OPTMODEL
Room 306B

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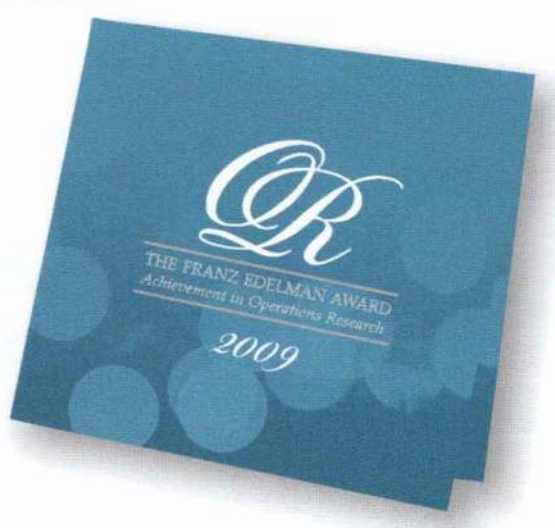

Visit the INFORMS booth to receive your complimentary member copy. Purchase a 2nd copy for $45.
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Whether you work in industry, government or consulting, you'll find the best applications resources at the INFORMS Annual Meeting.

CPMS: The Practice Section of INFORMS
Sunday-Tuesday
Track 26, Center-31B, Upper Level
Real-world applications are the focus of sessions organized by CPMS, the Practice Section of INFORMS. Included are presentations by speakers from Boeing, GE Research, IBM, ExxonMobil, FAA and other leading organizations.

Certification Process for OR/MS Professionals
Sunday-Monday
Track 26, Center -31B, Upper Level
Two sessions focus on the development of a certification process for O.R. practitioners. The first session (SA26) offers three presentations on establishing standards, taking education into account for credentialing, and single- versus multi-level certification. The second session (MA26) features a panel discussion organized by an INFORMS task force that is studying certification. Interested attendees are encouraged to provide new ideas, opinions and feedback as the panel discusses the issues and concerns related to certification.

2009 Daniel H. Wagner Prize Competition
Sponsored by CPMS, The Practice Section of INFORMS
Monday-Tuesday
Track 42, Hilton – Sapphire P, 4th Floor
The Wagner Prize Competition recognizes the quality and coherence of analysis used in practice, with an emphasis on good writing, strong analytical content and verifiable practice success. In three sessions on Monday, the 2009 competitors will present projects undertaken for six companies: Schneider National, IBM, Hub Group, Intel, GE Energy and Petrobas. On Tuesday morning (TA42), the winner will be announced and will reprise their presentation.

Reprise: 2009 Edelman Finalists & Winner - INFORMS Prize
Sponsored by CPMS, The Practice Section of INFORMS
Monday-Tuesday
Track 26, Center-31B
Keynote, Monday (3:10-4:00pm),
Hilton-Sapphire I, 4th Floor
The 2009 Edelman Competition finalists and the 2009 INFORMS Prize winner will reprise their presentations in Track 26 on Monday and Tuesday. The Edelman Prize recognizes analytics projects that had major impacts on their client organizations. The 2009 finalists are: CSX Railway, IBM, Marriott International, Norske Skog and Zara. The INFORMS Prize is awarded annually to a company that effectively integrates applied OR/MS principles into organizational decision making. The 2009 winner is Intel Corporation. On Monday at 3:10-4:00pm, the 2009 Edelman winner, Hewlett-Packard, will reprise their winning presentation in a keynote address.

O.R. Practice in INFORMS Roundtable Companies
Sponsored by the INFORMS Roundtable
Tuesday (TB68)
Track 68, Hilton-206, 2nd Floor
This special session will feature presentations on O.R. at three Roundtable companies. Included are talks on optimization applications at SAS Institute, improving operations at GE, and the practice of OR/MS inside Intel Corporation.

CPMS Isolated Practitioner Workshop & Reception
Monday, 6:15-7:15pm
Center – Room 31B, Upper Level
This special event is geared to the interests of isolated practitioners, the "Lone Rangers" of OR/MS. The 26th workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome; wine and cheese will be served.

Tutorials
Sunday-Wednesday
See pages 31-33 for abstracts and schedule.
These 90-minute sessions offer an in-depth look at current methodologies. Topics include global operations management, lean Six Sigma in services, open-source software, innovation and product development, logistics and transportation in global supply chain and more. INFORMS has published nine of the tutorials in a CD. All meeting registrants can pick up a complimentary CD. A Tutorials coupon was included in your badge envelope; bring it to the tutorials booth next to the registration desk or to the INFORMS booth in the exhibit hall (#41-43) to pick up your CD. Book format and additional CDs may also be purchased during the meeting at discounted prices.

Software Demonstrations
Sunday–Wednesday
See pages 34-36 for abstracts and schedule.
See new product releases, case studies and software presented by leading vendors and solution providers.

2010 INFORMS CONFERENCE ON O.R. PRACTICE
APPLYING SCIENCE TO THE *Art of Business*
April 18-20, 2010
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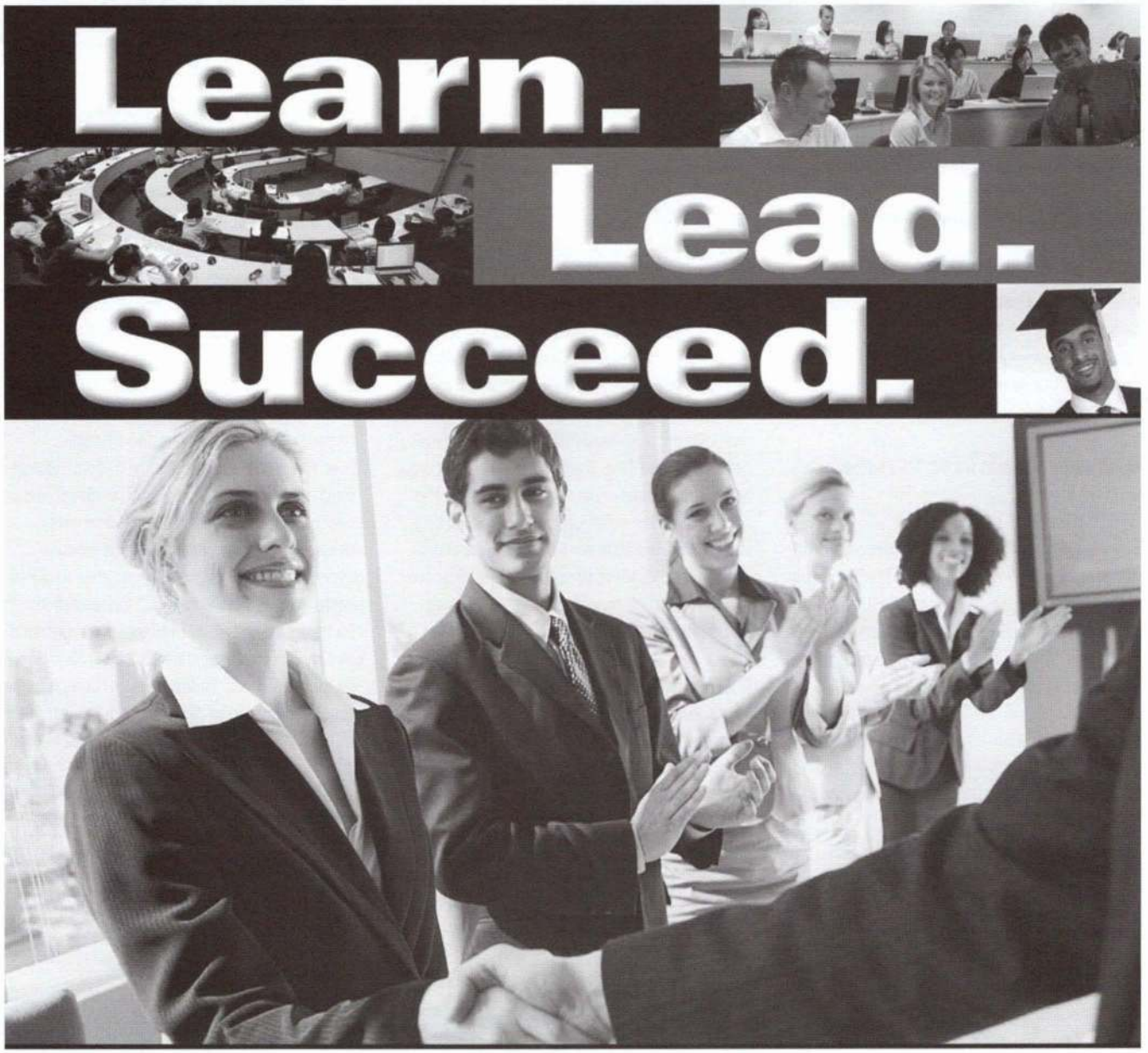

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2009 Combined Colloquia and Teaching Effectiveness Colloquium
Friday-Saturday
Hilton - schedule and room locations on page 7.
The Teaching Effectiveness Colloquium (TEC) is a two-day program beginning on Friday morning. The Future Academician (FAC) 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 Lehigh University, Omega Rho and SAS.

Organization Science: Dissertation Proposal Competition
Saturday, 8:30am-5:00pm
Hilton – 204A, 2nd Floor
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 2009 – Conference on Information Systems and Technology
Saturday-Sunday
Hilton – Room 206 & Indigo B, 2nd Floor
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 the MIS Quarterly; University of Connecticut, OPIM; University of Texas at Dallas, School of Management; Carnegie Mellon University, Heinz College; Emory University; New York University, CEDER; Indian School of Business, SRITNE; and Georgia Institute of Technology, College of Management.

Service Science Section Doctoral Consortium
Monday, 12:30pm-1:30pm
Hilton – Room 402, 4th Floor
The main objectives of the consortium are networking and information-sharing. The consortium will be an opportunity for PhD students to discuss their research and career plans with senior members of the service science community from industry and academia.

Sponsored by IBM Research.

IBM
Research

San Diego Area High School Math Teacher Workshop
In Conjunction with Project MINDSET
Tuesday
San Dieguito High School Academy, Encinitas, CA

Two Sessions:
Full-Day - 8:15am-3:00pm
Deterministic and Probabilistic Real World Decision Models: Five Topics
Half Day - 4:30pm-7:30pm
Primarily Deterministic Real World Decision Models: Three Topics

The Public Awareness Committee of INFORMS has been sponsoring Teacher Workshops for many years at annual meetings, and countless educators have learned mathematical applications for the real world. As an outgrowth of this effort, the National Science Foundation awarded a five-year grant for $3 million to a joint effort by faculty at North Carolina State University, Wayne State University and University of North Carolina-Charlotte. The project team for Mathematics Instruction using Decision Science and Engineering Tools (MINDSET) has completed development of two semester long textbooks. One text involves deterministic models; the second is built around probabilistic decision-making. The texts emphasize problem formulation, multi-step problem solving, and interpretation of results. The proposed two-semester course is primarily designed for seniors in high school who have already completed Algebra II. These two alternative workshops will explore several of the topics covered in these texts. All participants will receive a copy of *Does This Line Ever Move: Everyday Applications of Operations Research*, by Kenneth Chelst and Thomas Edwards (Key Curriculum Press).

Sponsored by INFORMS, San Diego County Office of Education, National Science Foundation, Wayne State University, North Carolina State University, and University of North Carolina-Charlotte.

JOB PLACEMENT SERVICES

Job Fair
Sunday, 12:00pm-5:00pm
Convention Center – Exhibit Hall H
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 H
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 Industry Job Search
Monday – MC22, 1:30pm-3:00pm
Convention Center – Room 30C

The Academic Job Search
Monday – MD22, 4:30pm-6:00pm
Convention Center – Room 30C

PLENARY & KEYNOTE *Presentations*

SUNDAY

WELCOME & OMEGA RHO DISTINGUISHED LECTURE

10:00am-10:50am
Hilton-Sapphire I, 4th Floor

Welcome
Don N. Kleinmuntz
President, INFORMS
Executive Vice President,
Strata Decision Technology LLC

Soheila Jorjani
General Chair,
INFORMS Annual Meeting San Diego
Associate Professor, California State University-San Marcos

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 38 active collegiate chapters and more than 6,000 student and faculty members. It 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 and to its local chapters.

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, Hau L. Lee will be inducted as the 43nd Honorary Member of Omega Rho.

Omega Rho Distinguished Lecture

Socially and Environmentally Responsible Supply Chains

Hau L. Lee
Thoma Professor of Operations, Information and Technology
Stanford University, Graduate School of Business

Social and environmental responsibility has increasingly become an issue of high importance in the corporate as well as in the public world. In particular, companies are also working on ensuring that supply chains are socially and environmentally responsible. Interestingly, many socially and environmentally responsible supply chains happen to be ones that are also highly successful in business performance. What are the key issues and concerns that have gained attention in industry on socially and environmentally responsible supply chains? What new teaching materials are useful? What new research ideas are forming? I will give an overview and examine current developments on environmentally sound supply chains, social welfare and equity issues, ways to help develop effective supply chains in under-developed countries, advancements in humanitarian disaster relief and aid efforts, and innovations to help bring economic development to emerging economies. I will also comment on how OR/MS can play a role in such an evolution.

Hau L. Lee is the founding and current Director of the Stanford Global Supply Chain Management Forum, an industry-academic consortium to advance the theory and practice of global supply chain management. His areas of specialization include supply chain management, information technology, global logistics system design, inventory planning and manufacturing strategy. He has published widely in journals such as *Management Science, Operations Research, Harvard Business Review, Sloan Management Review* and *Interfaces*.

Dr. Lee received the Harold Larnder Prize for International Distinction in Operations Research, Canadian Operations Research Society (2003). He was elected a Fellow of Manufacturing and Service Operations Management (2001), Production and Operations Management Society (2005) and INFORMS (2005). He was the President of the Production and Operations Management Society (2006-07). Dr. Lee's article, "The Triple-A Supply Chain," was the Second Place Winner of the McKinsey Award for the Best Paper in 2004 in the *Harvard Business Review*. His co-authored paper (1997), "Information Distortion in a Supply Chain: The Bullwhip Effect," was voted as one of the ten most influential papers in the history of *Management Science* in 2004. Dr. Lee received an MSc degree in operational research from the London School of Economics in 1975, and MS and PhD degrees in operations research from the Wharton School of the University of Pennsylvania in 1983. He was awarded an Honorary Doctor of Engineering degree by the Hong Kong University of Science and Technology in 2006, and an Honorary Doctorate from Erasmus University, Rotterdam in 2008.

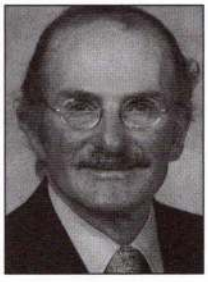
KEYNOTE

3:10pm-4:00pm
Hilton, Sapphire I, 4th Floor

There is More Mathematics in the Future of Biotechnology

Charles R. Cantor
Founder and Chief Scientific Officer
SEQUENOM, Inc.

Biology has typically been the domain of people who love science but eschew mathematics. In the past two decades there have been fundamental changes in the way biological scientists view much of their field. This is largely spurred by vast improvements in our ability to collect massive amounts of quantitative data on biological samples. At the same time computational methods have increased in capacity to begin to be able to deal with the complexity of biological systems. In this talk, I will demonstrate four aspects of this convergence: the complexity of biological systems, initial attempts to model such systems quantitatively, the genetics of complex human traits and the challenges posed by stochastic noise in biological systems and samples. How the latter affects a very practical objective: noninvasive prenatal diagnostics will be illustrated.



Charles R. Cantor is a founder, Chief Scientific Officer and Member, Board of Directors, at SEQUENOM, Inc. He is also the founder of SelectX Pharmaceuticals, a drug discovery company based in the Boston area; Retrotope, an anti-aging company; and DiThera, a biotherapeutic company. He is Co-director of the Center for Advanced Biotechnology at Boston University and Professor of Biomedical Engineering. Dr. Cantor has held positions at Columbia University and University of California at Berkeley, and was director of the Human Genome Center of the Department of Energy at Lawrence Berkeley Laboratory. He has published more than 450 peer-reviewed articles and has been granted more than 60 patents. He co-authored a three-volume textbook on biophysical chemistry and the first textbook on genomics, *The Science and Technology of the Human Genome Project.* He sits on the advisory boards of more than 15 national and international organizations and is a member of the National Academy of Sciences.

KEYNOTE

3:10pm- 4:00pm
Hilton, Sapphire M, 4th Floor

Worldwide Reach into High School Math and Science Classes

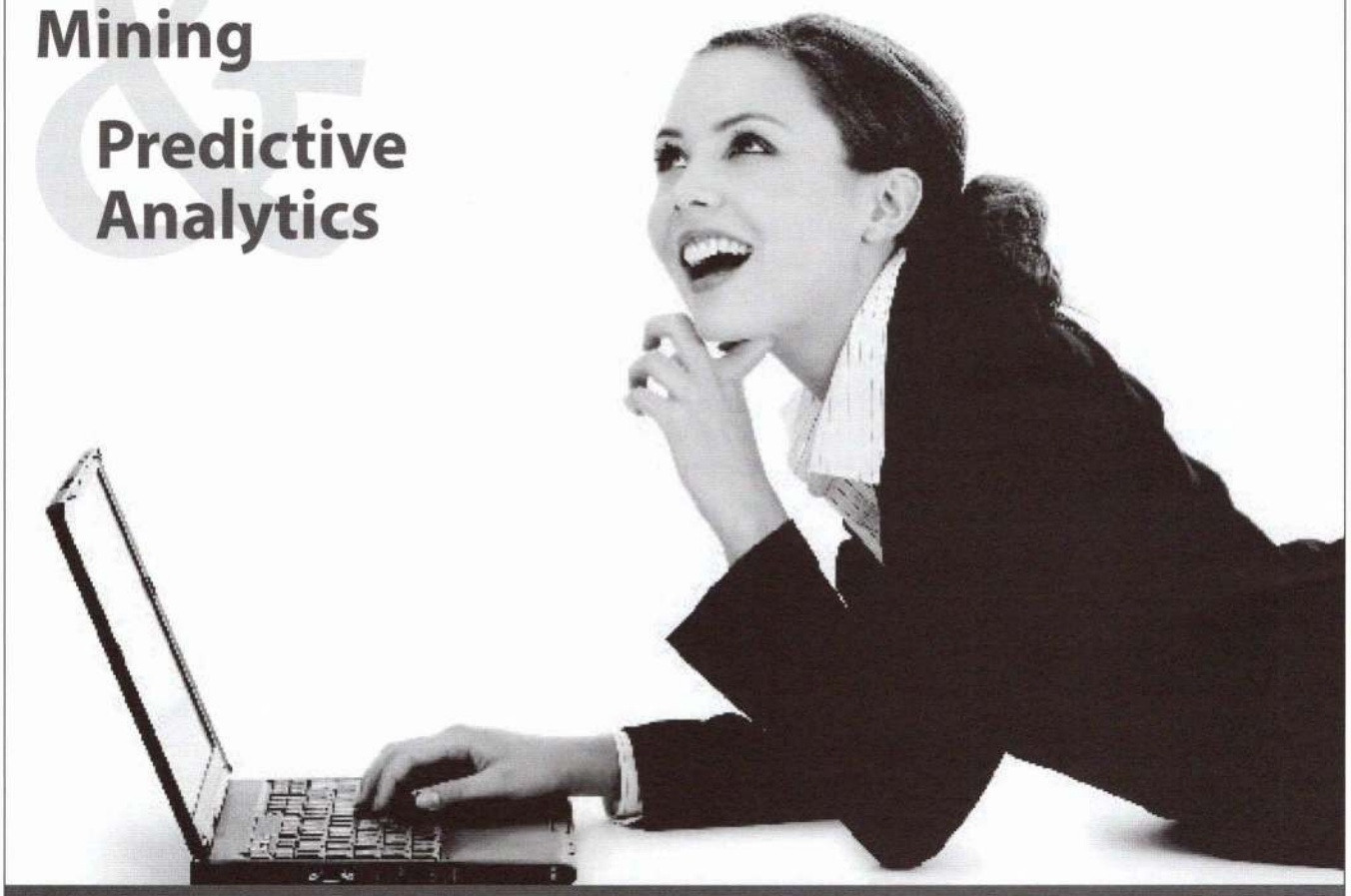
Richard C. Larson
Mitsui Professor, Engineering Systems Division;
Founding Director, Center for Engineering System Fundamentals
Massachusetts Institute of Technology

BLOSSOMS is a program developing interactive learning videos for high school math and science classes in many countries. BLOSSOMS = Blended Learning Open Source Science or Math Studies (http://blossoms.mit.edu). We seek wide participation from the INFORMS community to design and create BLOSSOMS modules and to tell their local high schools of their existence! BLOSSOMS foreign partners are in Jordan and Pakistan, and we are hoping to add more soon. A BLOSSOMS video presents the students with a challenging problem that they have not seen in state-mandated curricula, and seeks to develop critical thinking skills. The focus is away from rote learning and teaching to a test. While science subjects in biology and physics are included, the major contributions to BLOSSOMS have been in applied mathematics, including OR-related topics. The pedagogical model keeps the students in their regular seats with their regular teacher in charge of the class. Each video module works in teaching segments, five minutes or less, then fades to black as the in-class teacher takes over in an iterative "teaching duet." Full lesson plans are included. We include demonstrations of BLOSSOMS videos, including OR materials. We ask the audience to consider adding to this shared open source video repository.

Richard C. Larson received his PhD from MIT. The majority of his career has focused on operations research as applied to services industries. He is author, co-author or editor of six books and author of over 85 scientific articles, primarily in the fields of urban service systems, queueing, logistics, disaster management, disease dynamics, dynamic pricing of critical infrastructures and workforce planning. His first book, *Urban Police Patrol Analysis* (MIT Press, 1972) was awarded the Lanchester Prize. He served as President of ORSA, (1993-94) and INFORMS (2005). Dr. Larson's research on queues has not only resulted in new computational techniques, but has also been covered extensively in national media (ABC TV's *20/20*, NPR and the *New York Times*). He served as Co-Director of the MIT Operations Research Center for over 15 years. He is a member of the National Academy of Engineering, an INFORMS Founding Fellow and has been honored with the INFORMS President's Award and the Kimball Medal.

Dr. Larson served as Director of MIT's CAES, Center for Advanced Educational Services (1995-2003). CAES focused on bringing technology-enabled learning to students living on the traditional campus and to those living and working far from the university. He is founding Director of LINC http://linc.mit.edu, Learning International Networks Consortium. He recently started LINC's newest initiative, BLOSSOMS, sponsored by the Hewlett Foundation with additional support from the Sloan Foundation. On behalf of LINC, his recent foreign trips have been to China, Japan, Senegal, Iran, Indonesia, Algeria, Pakistan, Jordan, Kuwait and the UAE.

Data Mining & Predictive Analytics



Salford Systems' data mining tools are the only licensed implementations of the methodologies originally developed by world-renowned statisticians Leo Breiman, Jerome Friedman, Richard Olshen, Charles Stone, and Adele Cutler. They continue to be enhanced by Salford Systems in exclusive collaboration with their creators, perfecting and extending the technologies to add new features and capabilities.

Salford tools are especially useful when dealing with

- Databases with many missing values and flawed data
- Response patterns depending on the interaction of many variables
- Large data sets (many rows, many columns, or both)
- Data sets with few observations with many variables
- Data with very low response rates or when very high lifts are required

Introduction to Data Mining for Absolute Beginners

8:45 am - 9:30 am
Tuesday, October 13th
Convention Center, Room 27B
Presented by Salford Systems

Getting Started with Data Mining

12:00 pm - 2:30 pm
Tuesday, October 13th
Hilton, Room 305
Presented by Salford Systems

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MONDAY

PLENARY

10:00am-10:50am
Hilton-Sapphire I, 4th Floor

Investing in the Smart Grid

Mark M. Little
Senior Vice President and Director
GE Global Research

Despite today's economic challenges, the time is now to make big investments in the next generation of energy systems such as the Smart Grid. With an ever-growing mix of energy sources coming online, as well as distributed energy sources being installed in neighborhoods and business parks, smarter and more automated systems are a necessity to realize performance objectives such as cost minimization, demand management, carbon footprint reduction, and reliability. Mark Little, Chief Technology Officer for GE, will discuss where GE sees opportunities for technology development and areas where GE is placing bets to optimize the performance of electrical grids around the world.

Mark M. Little was named Senior Vice President and Director of GE Global Research in October 2005, becoming the ninth director in the organization's 105-year history. He is responsible for leading one of the world's largest and most diversified industrial research and technology organizations. At GE Global Research, some 2,500 people from virtually every major scientific and engineering discipline focus on the company's long-range technology needs. Prior to becoming Research Director, Dr. Little was Vice President of GE Energy's power generation segment in Schenectady, New York. GE Energy is a world leading supplier of power generation equipment including gas, steam, wind and hydro turbine-generators, turnkey power plant services, gasification technologies and IGCC (integrated gasification combined cycle).

Dr. Little joined GE in 1978, starting out in the Company's Turbine Business. He has held many management and executive positions since then, including Vice President, Power Generation Engineering and Vice President, GE Power Generation. Dr. Little holds BS and MS degrees in mechanical engineering from Tufts and Northeastern universities, respectively, and in 1982 earned a PhD in mechanical engineering at Rensselaer Polytechnic Institute.

KEYNOTE

3:10pm-4:00pm
Hilton, Sapphire I, 4th Floor

Edelman Reprise Presentation

HP Transforms Product Portfolio Management with Operations Research

Presenters:
Kathy Chou, Hewlett-Packard Personal Systems Group
Chris Fry, Strategic Management Solutions
Bin Zhang and Julie Ward, Hewlett-Packard Labs

Co-authors:
Bin Zhang, Shailendra Jain, Hewlett-Packard Labs
Thomas Olavson, Hewlett-Packard SPaM
Holger Mishal, Hewlett-Packard Personal Systems Group

HP offers a wide spectrum of innovative products to meet diverse customer needs. While the breadth of HP's product offering has helped the company achieve unparalleled market reach, it has come with significant costs and challenges. HP developed two powerful operations research based solutions for product variety management that, together, address the diverse needs of its businesses throughout their products' lifecycles. The first, a framework for screening new products, uses custom-built ROI calculators, based on statistical analysis and inventory theory, to evaluate each proposed new product before it is introduced. The second solution, HP's Revenue Coverage Optimization (RCO) Tool, based on a fast new maximum flow algorithm, is used to manage product variety after it has been introduced. By using these tools, since 2005, HP achieved over $500M in profit improvements across several business units and increased customer satisfaction and market share.

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 2009 finalists include CSX Transportation, IBM, Marriott International, Norske Skog and Zara. In this keynote, the first-place Hewlett-Packard team will reprise their winning presentation.

KEYNOTE

3:10pm-4:00pm
Hilton, Sapphire M, 4th Floor

Supply Chain Risk Management

Christopher S. Tang
Edward Carter Professor of Business Administration
UCLA Anderson School of Management

Recent supply chain disruptions have caused many company executives, practitioners and researchers to show greater interest in developing better ways to manage supply chain risks. As an emerging area of practice and research, there are three major gaps in the development of supply chain risk management (SCRM) as a field. These three gaps are: definition gap (no consistent definition), process gap (no clear focus) and methodology gap (little analytical work). In this presentation, we present these three major gaps, solicit your views on these gaps and exchange ideas for closing these three gaps.

Presentation jointly prepared by ManMohan Sodhi and Christopher Tang.

Christopher S. Tang has served many roles at the UCLA Anderson School of Management for over 20 years including Chairman and Senior Associate Dean. Recently, he served as Dean of the National University of Singapore business school as well as the Senior Advisor to the President at the National University of Singapore. He has extensive teaching, research and consulting experience in the areas of supply chain management and retailing. In addition to winning various teaching awards, he has published three books, over 70 research articles in various leading international academic journals and articles in *Wall Street Journal* and *Financial Times*. Dr. Tang has taught various executive programs, served on 15 editorial boards including *Production and Operations Management* and advised clients throughout United States, Europe and Asia. He received his BSc (First Class honors) from King's College, University of London, MA, M.Phil and PhD from Yale University.

PLENARY & KEYNOTE *Presentations*

TUESDAY

PLENARY

10:00am-10:50am
Hilton-Sapphire I, 4th Floor

Informing the Globe with Wireless: Opportunities for Innovation and Impact

Irwin Mark Jacobs
Board Member and Co-Founder
Qualcomm, Inc.

With over four billion subscribers to cellular worldwide, an increasing number with mobile wideband access to the Internet, and with wireless devices becoming increasingly smart and compact, the opportunities to apply wireless to all aspects of our life are often bounded only by our imagination. Dr. Jacobs will touch on the history of Qualcomm and then examine continuing developments in the technology, devices and applications. He will describe several projects applying wireless in medicine, farming and fishing, micro-finance, education and in machine-to-machine communications.

Irwin Mark Jacobs is a board member of Qualcomm, Inc., a company he co-founded in 1985. As CEO through 2005 and Chairman through 2009, he led the growth from startup to Fortune 500 company. He holds thirteen CDMA patents. Dr. Jacobs previously served as Co-Founder, CEO and Chairman of Linkabit Corporation, leading the development of Very Small Aperture Earth Terminals (VSATs) and the VideoCipher® satellite-to-home TV system.

Dr. Jacobs received master of science and doctor of science degrees in electrical engineering from MIT. From 1959 to 1966, he was an assistant, then associate professor of electrical engineering at MIT. While at MIT, he co-authored with Jack Wozencraft a textbook in digital communications, *Principles of Communication Engineering*, still in use today. Dr. Jacobs was named Chair of the National Academy of Engineering in July 2008. He is the recipient of numerous industry, education and business awards, including: election to the National Academy of Engineering, 1982; the National Medal of Technology Award, 1994 (the highest award bestowed by the president of the U.S.), for extraordinary achievements in the commercialization of technology; the IEEE Alexander Graham Bell Medal, 1995; Lifetime Achievement Award, *Financial Times*, 2005; and more. He and his wife Joan have been cited by *Business Week* as among the 50 Most-Generous Philanthropists in the U.S.

KEYNOTE

3:10pm-4:00
Hilton-Sapphire I, 4th Floor

Globalization and the Residential University

Thomas L. Magnanti
Institute Professor and Former Dean of Engineering
Massachusetts Institute of Technology

Globalization has become a watchword of our times. The term engenders massive and pervasive dialog regarding its influence and impact, and even its definition. As Kofi Annan has asserted, "It has been said that arguing against globalization is like arguing against the laws of gravity." How will, or should, globalization change the landscape of higher education? What opportunities and challenges does globalization offer universities in general, and engineering schools in particular? What about operations research? This talk will offer some thoughts on these issues, drawing in part from recent initiatives undertaken by MIT.

Thomas Magnanti is one of sixteen Institute Professors at MIT and former Dean of MIT's School of Engineering. He has devoted much of his professional career to education that combines engineering and management and to teaching and research in applied and theoretical aspects of large-scale optimization. As Dean, he focused on educational innovation, industrial and international partnerships, technology-based entrepreneurship, diversity and innovation in emerging domains such as bioengineering, tiny technologies, information engineering and engineering systems. He has led several centers and programs at MIT including, as the founding co-director, MIT's Leaders for Manufacturing and System Design and Management Programs and, as founding director, the Singapore-MIT Alliance for Research and Technology (SMART). He has served as president of ORSA, INFORMS and IFORS and editor of *Operations Research*.

Dr. Magnanti has received numerous educational and research awards and honorary degrees and has served on a number of corporate and university boards. He is a member of the U.S. National Academy of Engineering and the American Academy of Arts and Sciences. He has an undergraduate degree in chemical engineering from Syracuse University, and masters' degrees in statistics and in mathematics as well as a PhD in operations research, all from Stanford University.

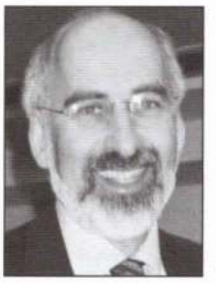
KEYNOTE

3:10pm-4:00
Hilton-Sapphire M, 4th Floor

A Banquet of Consequences: Adventures in Climate Policy Modeling

John D. Sterman
Jay W. Forrester Professor of Management
Massachusetts Institute of Technology

Why is the world so slow to address the risks posed by climate change? The problem is not imperfect scientific understanding, nor lack of computer models, but the failure of scientists to understand how policymakers and citizens think. The result: our models are often ignored. I discuss widespread but erroneous mental models people use to think about complex systems, and present fast and flexible simulation models that provide people with the ability to discover, for themselves, the likely consequences of proposals to cut greenhouse gas emissions, models now being used by senior policymakers in the U.S. and other nations.



John D. Sterman is the Jay W. Forrester Professor of Management at the MIT Sloan School of Management and Director of MIT's System Dynamics Group. His research includes systems thinking and organizational learning, computer simulation of corporate strategy, and environmental sustainability. He is the author of many scholarly and popular articles on the challenges and opportunities facing organizations today, including the book *Modeling for Organizational Learning* and the award-winning textbook *Business Dynamics*. His research centers on improving managerial decision making in complex systems, focusing recently on environmental sustainability, climate change and alternative vehicles. He has pioneered the development of "management flight simulators" of corporate and economic systems.

Dr. Sterman's work on management flight simulators was selected as one of the top 50 articles published in the first 50 years of the journal *Management Science*. He has twice been awarded the Jay W. Forrester Prize for the best published work in system dynamics, won a 2005 IBM Faculty Award and was named one of the Sloan School's "Outstanding Faculty" by the *Business Week Guide to the Best Business Schools*. He has been featured on public television's News Hour, NPR, CBC television, Fortune, the *Financial Times* and in other media for his research and innovative use of interactive simulations in management education.

WEDNESDAY

PLENARY

10:00am-10:50am
Hilton-Sapphire I, 4th Floor

Global Supply Chain Management Education

Yossi Sheffi
Director, Engineering Systems Division
Massachusetts Institute of Technology

Over the last six years, the MIT Center for Transportation and Logistics opened two research and education centers in supply chain management: one in Zaragoza, Spain and the other in Bogota, Colombia. This talk will cover the efforts, the metrics of performance for the university, the educational programs and the models used (they are very different in Colombia and Spain). The programs in both locales will be described as well as the integration with MIT. The talk will also discuss the role of the university in economic development, ties with industry, working with local universities and future plans. A question and answer session will follow.

Yossi Sheffi is a professor at the Massachusetts Institute of Technology, where he serves as Director of MIT's Engineering Systems Division and the MIT Center for Transportation and Logistics. He is an expert in systems optimization, risk analysis and supply chain management. He is the author of dozens of scientific publications and two books. Under his leadership, CTL launched many new educational, research and industry/government outreach programs, leading to substantial growth. In 2003 he launched the MIT-Zaragoza program, building a new logistics university in Spain based on a unique international academia, government and industry partnership. In 2008 he launched the Center for Latin-American Logistics Innovation in Bogota, Colombia, with participation of dozens of Latin-American universities and businesses.

Dr. Sheffi obtained his BSc from the Technion in Israel (1975), his SM from MIT (1977) and PhD from MIT (1978). He has been recognized in numerous ways in academic and industry forums. In 1997 he won the Distinguished Service Award given by the Council of Supply Chain Management Professionals. In 2002/03 he was on sabbatical in the Judge Institute of Management in Cambridge University, UK. In 2006 the Government of Aragon awarded him the Plaza Award for the most significant contribution to the economy of Aragon.

ENGAGE WITH ONLINE TOOLS AT THE ANNUAL MEETING

http://meetings.informs.org/SanDiego09

Blogs
Go to the Annual Meeting website during the meeting for commentary from your friends and colleagues. INFORMS has engaged a team of notable members including Mary Crissey, Fang Fang, Matt Saltzman, Michael Trick and others to share their thoughts and experiences. Agree or disagree with what they say? Be sure to add your own comments to the blogs. Blogs will be posted in real time to the Annual Meeting website before, during and after the meeting. Be sure to look back frequently for posts from our team of bloggers.

Tweets
All attendees are invited to let us know what you are seeing and doing at the Annual Meeting by tweeting about it. Be sure to add the hashtag "#informs09" to the beginning or end of your tweets to identify them as pertaining to the INFORMS Annual Meeting. Tweets with "#informs09" will be collected and added to the Annual Meeting website Meetings staff will also use Twitter to communicate late-breaking changes to the program.

LinkedIn
INFORMS has launched a LinkedIn Group devoted to the Annual Meeting for attendees and non-attendees alike to discuss important issues of the day. You are invited to join the group. Go to the Annual Meeting website to find a link leading to the Annual Meeting LinkedIn group.

PHOTOS AND VIDEO

Attendees are encouraged to take photos and video at the Annual Meeting. E-mail your photos and video to photosandvideo@mail.informs.org for posting on the Annual Meeting website. Contributors will be eligible to win one of two Flip Video Mino Series. Flip Video is one of the best-selling, easy-to-use video camcorders on the market. Visit http://www.theflip.com to learn more. To view the contest rules, including the type of photos and videos you may or may not shoot, visit http://meetings.informs.org/SanDiego09/flip.html.

FREE! 2009 EDELMAN DVD

Stop by the INFORMS booth to pick up your complimentary copy of the 2009 Edelman DVD set. Simply present the coupon you receive in your registration envelope and walk away with six great presentations on real-world, first-class operations research projects. Use the DVD to help sell colleagues and clients on the power of O.R. or as an effective classroom aid.

FREE! 2009 TUTORIALS CD

Stop by the meeting registration desk to pick up your complimentary copy of the 2009 TutORials CD. This year, INFORMS has published nine tutorials designed to provide you with enduring information from the Annual Meeting on state-of-the-art O.R. solutions to vexing problems. Simply present the coupon you receive in your registration envelope and walk away with this unmatched Annual Meeting resource. The accompanying soft-cover book and additional CDs may also be purchased in the INFORMS booth.

IOL LAUNCH PARTY

Sunday- 6:00pm-7:00pm
Hilton, Room 206, 2nd Floor
Come and see a demonstration of your new website. Slated to launch to the world in late November, the new IOL has been completely redesigned and re-architectured to serve both members and visitors better. Tell us what you think over refreshments and meet IOL Editor-in-Chief Mohan Sodhi.

Welcome INFORMS Annual Meeting Attendees!

TUTORIALS IN OPERATIONS RESEARCH

SPECIAL FREE DISTRIBUTION

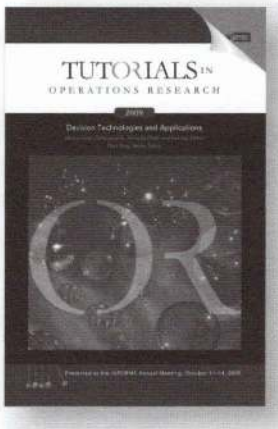
Your coupon for a free TutORials CD is included in your registration envelope. Redeem at the INFORMS registration desk or INFORMS Booth #41.

Your complimentary 2009 *TutORials in Operations Research* CD includes:

- 9 TutORial presentations.
- 200 plus pages of OR applications: HIV/AIDS prevention and treatment policies, logistics and transportation in global supply chains, and decision analysis technologies in the merger of ORSA and TIMS.
- Content from authors specializing in numerous areas of operations research covering a broad range of applications and methodologies.
- Searchable full-text articles in each chapter.

SPECIAL OFFER AT THE INFORMS BOOKSTORE:

The 2009 *TutORials in Operations Research* companion book is available for $25 only through October 14, 2009.



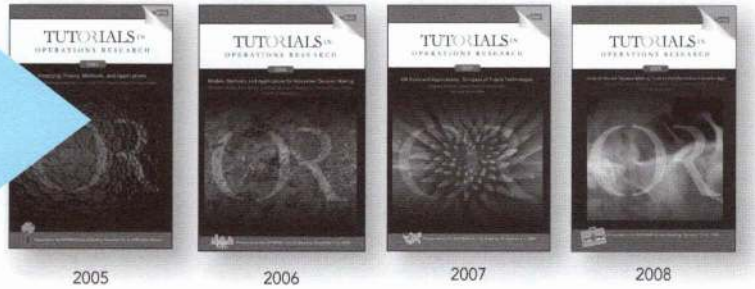
You may purchase additional CDs for $25 each.

Post-Conference Prices
Book: $45
CD: $45
Combo Pack: $75

INFORMS Bookstore is open Sunday from 12-5 & 7:30-9pm, Mon-Tues from 9-5pm, and Wed from 9-1pm.

Free TutORials CDs are available at Registration Desk from 7am Saturday through 5pm Wednesday.

Previous years titles of TutORials also available at the INFORMS bookstore, located at booth #43 in the Exhibit Hall.



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All tutorials are located in the Hilton.

SUNDAY

■ SB59 - Room 310
11:00am-12:30pm
Teaching Process Modeling Using IBM Software
Rick So, Paul Merage School of Business; Sharon McFadden, IBM Academic Initiative; Neil Sahota, IBM Global Business Services

In this tutorial, we share our approach and experience in teaching a process modeling class using the IBM Websphere Business Modeler. The class was offered to a group of about 15 MBA students. Through industry practitioners and deploying IBM commercial software, the students gain hands-on experience in analyzing and improving business process performance through process mapping and simulation. Specific support to class activities provided by IBM Academic Initiatives will also be discussed.

■ SC59 - Room 310
1:30pm-3:00pm
Supply Chain Management in the Context of Humanitarian Disasters
Luk Van Wassenhove, INSEAD

Disaster logistics differ from business logistics because of dynamic environments and the need for impartiality, neutrality and humanity. Funding is declining and disasters become more frequent; humanitarians increasingly rely on private organizations for help, although collaboration is difficult. We introduce disaster supply chain management, outline the need for better preparedness and response, discuss opportunities for effective collaboration and highlight opportunities for research.

■ SD59 - Room 310
4:30pm-6:00pm
25 Years of Interior Points Methods
Tamas Terlaky, Lehigh University

Karmarkar launched the age of IPMs in 1984. Hundreds of polynomial IPMs are designed. IPM software challenged simplex software. Duality theory, strict Complementarity and novel sensitivity analyses are explored. New problem classes, e.g. SOCO/SDO, are solved. Novel applications, e.g. robust IMRT, are solved. The theory and practice of optimization has changed forever. By now, the limits of IPMs are understood. Klee-Minty examples were constructed for IPMs and complexity bound is proved to be tight.

MONDAY

■ MA47 - Room 412
8:00am-9:30am
Interfaces of OM and Economics
Martin Lariviere, Northwestern University

This tutorial will examine the research interface between operations management and economics. We will discuss the evolution of this research, where we stand now and what questions remain open. Special attention will be paid to applications in supply chain contracting, principal-agent problems, and the role of strategic customers.

■ MA59 - Room 310
8:00am-9:30am
Geometric Programming
Thomas Jefferson, Optimal Duality Institute; Carlton Scott, University of California, Irvine

Beginning: the discovery by Zener of a novel way to solve engineering problems and provide closed-form sensitivity analysis; the theory of geometric programming developed with Duffin and Peterson. Extensions: signomial programming (Wilde and Passy); generalized geometric programming (Peterson); applications in engineering, science and business. Back to the future: revisit the original method of Legendre Duality to unify theory and solve non-convex problems in economics and business.

■ MB47 - Room 412
11:00am-12:30pm
OR/MS Challenges in Healthcare Informatics
Rema Padman, Carnegie Mellon University

Healthcare Informatics has emerged as an exciting, multi-disciplinary research area aimed at improving the quality and safety of patient care at reduced cost using information and decision technologies. We present an overview of a variety of challenging problems arising at the interface of healthcare, information technology and the management sciences.

■ MB59 - Room 310
11:00am-12:30pm
OR's Next Top Model: Decision Models for Infectious Disease Control
Elisa Long, Yale University; Margaret Brandeau, Stanford University

Infectious diseases continue to threaten many populations and timely control of these epidemics is a global health priority. Mathematical models can be used to estimate the costs and benefits of disease prevention, diagnostic and treatment interventions, and to aid policymakers with allocating limited disease-control resources. We describe several OR-based models used to analyze such problems. We illustrate each class of model with a published example applied to HIV/AIDS intervention policies.

■ MC47 - Room 412
1:30pm-3:00pm
Multiple Objective Decision Analysis Involving Multiple Stakeholders
L. Robin Keller and Yitong Wang, University of California-Irvine; Jay Simon, Naval Postgraduate School

We show decision analysis techniques using spreadsheets to help understand the multiple objective perspectives of decision stakeholders. Sometimes, one objectives hierarchy suffices for all, so differences in opinions across stakeholders can be characterized by differences in weights on the multiple objectives. In other cases, an objectives hierarchy will be constructed for each stakeholder. This helps us identify mutually agreeable actions, design new actions and foresee opposition.

■ MC59 - Room 310
1:30pm-3:00pm
Innovation and Product Development
Christian Terwiesch, The Wharton School

This tutorial establishes a problem-solving framework to product development. Taking this perspective has at least two advantages. First, the problem-solving view is sufficiently general that it allows us to abstain from favoring any one of the many existing academic disciplines associated with product development. Second, the problem-solving view will reveal many similarities between the existing literature streams and point to fruitful areas of future research.

BUENOS Aires

Association of Latin-Iberoamerican Operational Research Societies
Institute for Operations Research and the Management Sciences

2010

ALIO-INFORMS Joint International Meeting

June 6-9, 2010
Law School, University of Buenos Aires
Buenos Aires, Argentina

http://meetings.informs.org/
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Carlos Vidal, Universidad del Valle, Colombia
Yoshiko Wakabayashi, Universidad de Sao Paulo, Brasil

Teaching Effectiveness Colloquium
James Cochran, Louisiana Tech University, USA
Marcela González, Universidad de Talca, Chile

■ MD47 – H-Room 412
4:30pm-6:00pm
Modeling Static Competitive Facility Location Problems: New Approaches and Results
Zvi Drezner and Tammy Drezner, California State University-Fullerton; Oded Berman and Dmitry Krass, University of Toronto

The gravity model applied to competitive facility location is described. We wish to find the locations for new facilities that attract the maximum buying power. Extensions include: modeling uncertainty, minimizing the probability of missing a threshold, flow interception, market expansion and lost demand, allocation of a given budget among one's facilities. Tools include: the generalized Weiszfeld procedure, the big triangle-small triangle global optimization and the tangent line approximation.

■ MD59 - Room 310
4:30pm-6:00pm
Cutting Plane, Cutting Surface and Subgradient Methods
John Mitchell, Rensselaer Polytechnic Institute

This talk provides an overview of four related topics. First, we discuss the incorporation of interior point methods into column generation, cutting plane and decomposition approaches. Secondly, we describe the use of semidefinite relaxations to find exact solutions to combinatorial optimization problems. Third, we consider cutting surface approaches to solving SDPs. Finally, we look at recent smoothing techniques for solving nonsmooth optimization problems using a subgradient approach.

TUESDAY

■ TA59 - Room 310
8:00am-9:30am
New Sphere Methods for LP
Katta G. Murty, University of Michigan

We discuss a new method being developed for solving linear programs that uses matrix inversion operations sparingly, and thus seems well suited to solve large-scale problems and those that may not have the property of being very sparse.

■ TB59 - Room 310
11:00am-12:30pm
Logistics and Transportation in Global Supply Chains: Review, Critique and Prospects
James H. Bookbinder and Tiffany A. Matuk, University of Waterloo

Logistics and transportation are paramount for a supply chain whose nodes are in different areas of the world. We review a number of research papers that emphasize activities distinguishing global supply chains. Supplier selection is also important domestically, but now involves border crossings and exchange rates. Switching production between countries, say, is uniquely international and depends upon tariffs, quotas and local content restrictions. We will discuss logistics for NAFTA and the EU.

■ TC59 - Room 310
1:30pm-3:00pm
Assessing Solution Quality in Stochastic Programs via Sampling
David Morton, The University of Texas at Austin; Guzin Bayraksan, University of Arizona

We present a simple, easily implemented procedure that uses Monte Carlo sampling to form a point and interval estimator on the optimality gap of a candidate solution to a stochastic program. We then discuss methods to reduce the computational effort, bias and variance of our simplest estimator. We also provide a framework that allows the use of these optimality gap estimators in an algorithm by providing rules to sequentially increase the sample sizes and to terminate.

■ TD59 - Room 310
4:30pm-6:00pm
Fractional Programming with Applications
Siegfried Schaible, Chung-Yuan Christian University; Ruey-Lin Sheu, National Cheng Kung University

In this session, we emphasize (1) the history of fractional programming and its relation to generalized convexity, (2) real world problems with a fractional structure, (3) algorithms and duality for solving fractional programs. Examples from the transportation sciences and wireless network planning will be mentioned. Different types of dualities for non-convex optimization are compared and a new unified solution method is proposed. We are treating both the single-ratio and multi-ratio case.

WEDNESDAY

■ WA59 - Room 310
8:00am-9:30am
Lean Six Sigma in Services
Uday Apte, Naval Postgraduate School

Two major process improvement methodologies, "Lean" and "Six Sigma," emerged separately in the twentieth century. Presently, we are witnessing the merger of these two and the emergence of "Lean Six Sigma." In this tutorial, we will provide an introduction and an overview of Lean Six Sigma with a specific emphasis on its application to service industries. The tutorial should help researchers and practitioners alike in teaching, consulting and the practice of OM.

■ WB59 - Room 310
11:00am-12:30pm
Open Source Overview for Operations Research Professionals
Robin Lougee-Heimer, IBM Research

In our lifetime, the culture and software labeled as "open source" has evolved from a niche activity to a mainstream movement. We introduce the key concepts, clarify the common misperceptions and frame the significant developments of open source for operations research professionals in academia and business.

■ WC59 – H-Room 310
12:45pm-2:15pm
Recent Advances in Nonlinear Programming
Leon Lasdon, University of Texas at Austin

We discuss the state-of-the-art in NLP algorithms and modeling systems, covering GRG, SQP and Interior Point methods, and both algebraic modeling languages and spreadsheet optimization. We review recent enhancements to GAMS and the Risk Solver Platform 9.5 from Frontline Systems. Applications to water flooding oil fields are described.

SOFTWARE *Demonstrations*

All software demonstrations are located in the Convention Center, Room 27B.

SUNDAY, OCTOBER 11

■ SA15
8:00am–8:45am
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. Our software is used in over 800 universities and schools worldwide for teaching risk analysis concepts. Teaching applications for Crystal Ball include financial risk analysis, valuation, engineering, portfolio allocation, cost estimation and project management.

8:45am–9:30am
American Optimal Decisions - Portfolio Safeguard by AORDA
Gaia Serraino, serraino@aorda.com

Portfolio Safeguard by AORDA is an advanced optimization package for risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (linear, quadratic, maximum, St. Dev., variance, probability, VaR, CVaR, cardinality, fixed-charge). Real-life case studies in Windows, MATLAB, C++, Run-File. Download problems/data from www.aorda.com/aod/psg.action.

■ SB15
11:00am–11:45am
AMPL Optimization LLC - Attacking Hard Mixed-Integer Optimization Problems through the AMPL Modeling Language
Robert Fourer, 4er@ampl.com
David M. Gay, dmgay@sandia.gov

There are many tricks for formulating complex optimization models by use of integer variables, but what's to be done when even the most advanced solvers can't produce results in reasonable time? We'll show how substantial improvements in performance can be achieved through carefully focused troubleshooting and experimentation facilitated by the power and flexibility of the AMPL modeling language and its solver interfaces.

11:45am–12:30pm
GAMS Development Corporation - Rapid Application Prototyping with GAMS
Lutz Westermann, lwestermann@gams.com

GAMS Development will demonstrate how an application can be built using GAMS. We'll use both fundamental modeling practices, our state-of-the-art solvers and the latest in data access and application integration tools to quickly produce a working application.

■ SC15
1:30pm–2:15pm
Vanguard System
Rob Suggs, rob.suggs@vanguardsw.com

Vanguard System solves a fundamental challenge of professional modeling groups – enabling stakeholders to interact with your models without requiring them to be modeling experts or to have licenses of your modeling software. See how Vanguard turns desktop models into interactive Web applications for forecasting, simulation, and optimization... without Web programming!

2:15pm–3:00pm
Gurobi Optimization - Hands on with the Gurobi Python Interactive Interface
Edward Rothberg, rothberg@gurobi.com

Gurobi Optimization provides robust, high-performance optimization software based on the latest linear and mixed-integer programming technologies. Gurobi includes an impressive full-access, interactive interface written in Python. We will take an in depth look at the Gurobi Python interactive interface and how it can be used as a powerful, rapid prototyping tool.

■ SD15
4:30pm–5:15pm
Microsoft Solver Foundation
John Oberon, joberon@microsoft.com

Solver Foundation is a pure, managed code runtime for mathematical programming, modeling and optimization. The session will focus on our computational integer programming effort. Our MIP solution is a branch and cut solver based on Dual Simplex, and is designed to enable 64bit and multi-core computation environments. We'll detail advanced presolve, Gomory mixed integer cuts, mixed integer rounding cuts, and local search heuristics.

5:15pm–6:00pm
Palisade Corporation - DecisionTools Suite Software Introduction
Stephan Beeusaert, sbeeusaert@palisade.com

Palisade's DecisionTools Suite includes seven software packages that can be used by a wide variety of departments and individuals within any organization to better assess risk and make well-informed decisions. This comprehensive example demonstrates how all the components of the Suite work together, and how they can work for you.

MONDAY, OCTOBER 12

■ MA15
8:00am–8:45am
SAS Global Academic Program - Introduction to ODS Statistical Graphics in SAS 9.2
Tom Bohannon, tom.bohannon@sas.com

The essential information you need to get started with ODS Graphics in SAS 9.2. ODS Graphics is an extension of ODS (the Output Delivery System), which manages procedure output and lets you display it in a variety of destinations, such as HTML and RTF. Consequently, many familiar features of ODS for tabular output apply equally to graphs. For statistical procedures that support ODS Graphics, you invoke this functionality with the statement ODS GRAPHICS ON.

8:45am–9:30am
JMP - Dynamic Visualization of Complex Data with JMP
Melodie Rush, melodie.rush@jmp.com
Mia Stephens, mia.stephens@jmp.com

JMP is state-of-the-art data analysis and visualization software. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. JMP contains a complete array of analytical procedures and always provides dynamic, visual representations alongside their statistical output. This demo will cover an overview of JMP and analysis designed for data visualization including Graph Builder®, Bubble Plots, and more.

■ MB15
11:00am–11:45am
Innovative Scheduling - Case Studies from the Field: What It Takes to Turn Models into Systems
Ravindra K. Ahuja, ravi@innovativescheduling.com

In this tutorial, attendees will learn what it takes to build successful model-based systems and how theory can be brought to practice to create success stories for the discipline. We will describe several business problems, their modeling, packaging into decision support systems, difficulties encountered, how we addressed them, and the lessons learned.

11:45am–12:30pm
Maximal Software - Why is Maximal Now Giving Away Free Development Copies of MPL?
Bjarni Kristjansson, bjarni@maximalsoftware.com

In today's challenging economy, many are now looking for ways to save on their IT budget, including when purchasing optimization software. We at Maximal have changed how we sell our software, by greatly reducing how much you pay for development copies of MPL. We will explain several new programs: "Pay Maintenance Only," "Subscription-Based Pricing," "Free Development Copies of MPL" and "Free Software for Academics."

■ MC15
1:30pm–2:15pm
LINDO Systems, Inc. - Optimization Modeling Made Easy
Mark Wiley, mwiley@lindo.com

LINDO Systems will demonstrate LINDO API, LINGO and WhatsBest their popular linear, integer, nonlinear and global optimization tools. Find out how easy it is to: quickly build complex optimization models; incorporate risk into your models; effortlessly access data in Excel and databases; seamlessly embed optimization into your own applications.

2:15pm–3:00pm
IBM ILOG CPLEX 12 Technology Update
John Gregory, jgregor@us.ibm.com

Used by more than 1,300 commercial customers, IBM ILOG CPLEX is the world's most trusted and widely used optimization software for mission critical applications. CPLEX 12 demonstrates IBM's commitment to IBM ILOG Optimization. Join us for an overview of the new performance and usability enhancements in CPLEX 12, which will allow you to solve models that are more realistic than ever.

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

Participate in a demonstration of online games that are used in operations management courses and supply chain management courses in hundreds of undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

5:15pm–6:00pm
LINKS-simulations.com - Best-Practice Teaching with a Sophisticated Supply Chain Management Simulation
Randall G. Chapman, chapman@chapmanrg.com.

Drawing on simulation design experience, extensive classroom and distance-learning teaching experience, and LINKS "train-the-trainer" experience with 100+ instructors and their 25,000+ students over the last ten years, the LINKS author provides best-practice insights to executing successful simulation-based operations management and supply chain management courses.

TUESDAY, OCTOBER 13

■ TA15
8:00am–8:45am
AnyLogic
Andrei Borshchev, andrei@xjtek.com

AnyLogic is the first and only simulation tool that supports system dynamics, process-centric (discrete event) and agent-based methods within one modeling language and one model development environment. We will demo several AnyLogic models and show how the user can benefit from using different modeling methods, and from agent-based modeling in particular.

8:45am–9:30am
Salford Systems - Introduction to Data Mining for Absolute Beginners
Mikhail Golovnya, golomi@salford-systems.com

We will discuss: (1) data basics: data types, formats, and preparation steps; (2) what kinds of questions we can answer with data mining; (3) how data mining models work; (4) evaluation criteria--how models can be assessed and their value measured; and (5) specific background knowledge to prepare you to begin a data mining project.

■ TB15
11:00am–11:45am
Imagine That - ExtendSim-Power Tools for Simulation
Dave Krahl, davek@extendsim.com

See how quickly you can build robust, intuitive models with the power tool for simulation - ExtendSim. Revolutionary new simulation technology and 3D animation in ExtendSim is paired with core ExtendSim features such as hierarchical model building, user interface creation, and interactive modeling to make it the tool to watch in the simulation industry. Don't miss this demo!

11:45am–12:30pm
AIMMS® (Paragon) - Monte Carlo Simulation Versus Stochastic Optimization
Peter Nieuwesteeg, p.nieuwesteeg@aimms.com
Deanne Zhang, deanne.zhang@aimms.com

There are different approaches to handle uncertainty in your model. We will show two of them and how you can use them in AIMMS, starting with a short introduction to AIMMS, followed by the ability to generate different solutions using solution pools and evaluating those solutions using Monte Carlo simulation. This will be followed by a demonstration of the stochastic programming feature in AIMMS.

■ TC15
1:30pm–2:15pm
Frontline Systems, Inc. - Risk Analysis and Robust Optimal Solutions: High Productivity Modeling in Excel
Daniel H. Fylstra, dfylstra@frontsys.com.

Learn how you can use Frontline's latest tools for management science education and practice. Risk Solver Platform for Education includes all features of the Excel 2007 and new Excel 2010 Solver, powerful risk analysis and Monte Carlo simulation, decision trees, stochastic programming and robust optimization, and the Gurobi LP/MIP Solver.

2:15pm–3:00pm
SAS - Building and Solving Optimization Models with OPTMODEL
Ed Hughes, ed.hughes@sas.com

Trevor Kearney, trevor.kearney@sas.com
We'll demonstrate the use of OPTMODEL's powerful algebraic modeling language to build and solve a range of models including LP, MILP, QP, and general NLP. We'll also illustrate how OPTMODEL can employ both standard and customized algorithms to tackle more challenging optimization problems, integrating easily with SAS data handling, analytic, and reporting capabilities as needed.

■ TD15
4:30pm–5:15pm
Lyzasoft, Inc. - Prep Your Data with Lyza: Get into the Heart of Your Modeling Faster
Brian Krasovec, brian.krasovec@lyzasoft.com

If you are frustrated by the tedious task of data preparation or hoping to get your students into the heart of their modeling more quickly – Lyza is for you. Come learn how our self-service approach will dramatically reduce the time it takes for you to profile, integrate, transform, and cleanse your data.

5:15pm–6:00pm
Syncopation Software - DPL: Powerful Decision Analytics
Chris Dalton, cdalton@syncopation.com

Learn about the powerful features in DPL! See how you can glean more insights with the Initial Decision Alternatives Tornado and Option Value Diagram. Save time in the pre-presentation crunch with the new endpoint replay capability. Go beyond project-level analysis by analyzing a portfolio of opportunities.

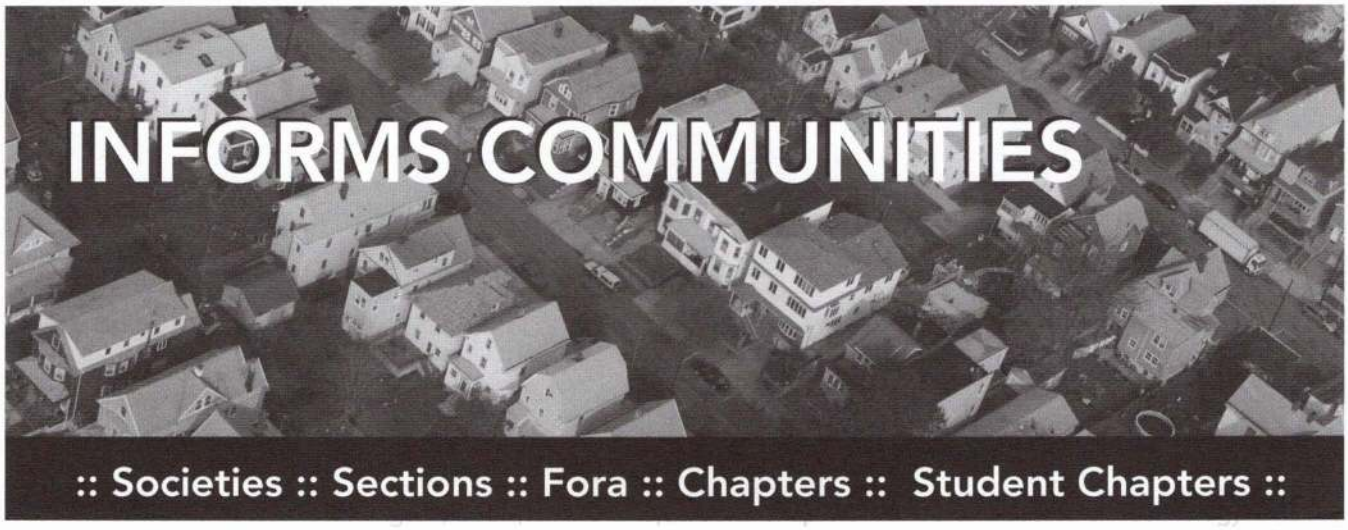
WEDNESDAY, OCTOBER 14

■ WA15
8:00am–8:45am
FICO - Building Optimization Applications in Xpress
Gabriel Tavares, gabrieltavares@fico.com

This tutorial will focus on developing and deploying complete optimization applications using the FICO Xpress Optimization Suite. Xpress can be used for modeling, solving, analyzing and visualizing optimization problems, and integrating them seamlessly in business applications. We will explain how Xpress-Mosel, Xpress-IVE, and Xpress-Application Developer can decrease development time for new optimization applications and enable you to make smarter decisions.

8:45am–9:30am
Lumina Decision Systems - Analytica: What it does that Spreadsheets Can't
Surya Swamy, surya@lumina.com

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



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MONDAY & TUESDAY

12:30pm-1:30pm
Convention Center-Exhibit Hall H

Researchers, practitioners and students share their OR/MS projects in these sessions presented as poster displays, laptop demonstrations and other creative formats. Authors will be on hand to present their work during the 12:30pm-1:30pm lunch periods on Monday and Tuesday in the Exhibit Hall.

A first-place award of $750 will be presented at each Interactive session. Several panels of distinguished OR/MS professionals will review and judge the presentations.

Monday Judges: Miguel Anjos, University of Waterloo; E. Andrew Boyd, PROS Revenue Mgt.; Manoj Chari, SAS Institute; Xiuli He, UNC-Charlotte; Stefan Karisch, Jeppesen; Jack Levis, UPS; Pelin Pekgun, JDA Software; Karthik Ramachandran, Southern Methodist Univ.; Cem Saydam, UNC-Charlotte; Jan Stallaert, Univ. of Connecticut.

Tuesday Judges: Ronald Askin, Arizona State Univ.; Rachel Chen, UC-Davis; Genetha Gray, Sandia National Labs; Zhiling Guo, Univ. of Maryland-Baltimore County; Bjarni Kristjansson, Maximal Software; Irv Lustig, IBM; Jonathan Owen, General Motors; Sanjay Saigal, Intechné; Yang Sun, California State Univ.-Sacramento; Julie Ward, Hewlett-Packard.

The Interactive Sessions are organized and chaired by Fang Fang, California State University San Marcos, and Erica Klampfl, Ford Research & Advanced Engineering.

Sponsored by CSU San Marcos

California State University
SAN MARCOS

MONDAY

ORA Network Analysis Software
Terrill Frantz, Carnegie Mellon University

Data Mining Application for Personnel Selection & Performance Evaluation in Banking
Ertan Guner, Gazi University

Consumer Loan Decision when Considering Profit, Volume and Variance on Profit
Kanshukan Rajaratnam, Univ. of Virginia

Ranking College Football Teams with AHP Concepts
Yepeng Sun, Univ. of Louisville

Sourcing Strategies for Relief Agencies Given In-kind Donations Availability
Luther Brock, North Carolina A&T State Univ.

Design Insights for Warehousing Systems Using Autonomous Vehicles Technology
Debjit Roy, Univ. of Wisconsin-Madison

Pattern Recognition and Sequence Analysis in Communications
Selcen Phelps, Westminster College

Development of a Multi-modal Trip Planner
Jing-Quan Li, Univ. of California Berkeley

Intellectual Property Management in Japanese Companies
Koichiro Kato, Kanazawa Institute of Technology

Reverse Logistics Network Design: MIP Model for Accumulator Recycling System
Bahar Özyörük, Gazi University

Tactical Production Planning with Deterioration and Perishability
Julia Pahl, Universität Hamburg

Solving Order Acceptance & Capacity Planning in Make-to-Order Operations with Branch and Price
Siddharth Mestry, Florida International Univ.

Estimating the Term Structure of Credit Spreads in Illiquid Markets
Gonzalo Cortazar, P. Universidad Catolica de Chile

Analysis of Knowledge Affected by Differences of Work Experience in the Intellectual Property Field
Masako Wakabayashi, Assoc. of Intellectual Property Education

Redundancy & Projection Operation in Lift-and-project Procedures for the Max-cut Problem
Jiwoong Choi, Korea University

Operations Research for Early Diagnosis of Breast Cancer
Turgay Ayer, Univ. of Wisconsin

A Quantitative Approach Towards Sustainable Organizations
Fikret Turan, Univ. of Pittsburgh

Evaluating Emergency Medical Service Dispatching Policies
Rebecca Dreiding, Virginia Commonwealth Univ.

Revenue Management & Capacity Allocation with Limited Information in Global Air Cargo Operations
Ravi Kumar, KAIST Business School

Heuristic-based Scheduling System for Diffusion Processing in Semiconductor Manufacturing
Tanju Yurtsever, Freescale Semiconductor, Inc.

Optimal Design of Business Processes
Ronald Giachetti, FIU

Linear Model for an Integrated Location-inventory Problem with Time-based Service Level Constraints
Eissa Nematollahi, York University

How to Protect Intellectual Property under R&D Outsourcing
Rajorshi Sen Gupta, Texas A&M University

Multi-objective Healthcare Decision Support: Case Studies in UK and China
Dylan Jones, University. of Portsmouth

Gem-cutting Strategies for Fast Simplex Variants and Combinatorial Proofs on Polytopes
Anand Kulkarni, University of California

Product Pricing and Company Wealth: An Example from the Airline Industry
Min Shi, California State University Los Angeles

Bound on Expected Objective Value of a Linear Programming with Uncertainty
Phantipa Thipwiwatpotjana, University of Colorado at Denver

A Fuzzy Combinatorial Optimization Model
Elizabeth Untiedt, Univ. of Colorado Denver

Optimal Security Response to Attacks on Open Science Grids
Zhen Xie, Argonne National Laboratory

Metamodeling-based Optimization Studies: Simulations and Experiments
Mauricio Cabrera-Ríos, Univ. of Puerto Rico at Mayagüez

Introducing Statistic Analysis in Materials Science Projects at Different Points in Time
Mauricio Cabrera, Univ. of Puerto Rico at Mayagüez

November 7–10, 2010

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Effects of Donations on Humanitarian Relief Performance: A Simulation Study
Lauren Davis, North Carolina A&T State Univ.

New Holistic Method for Complex Network Reliability Approximation & Critical Components Detection
Chi Zhang, Stevens Institute of Technology

Approximation of Stochastic Production Line Models of Continuous Material Flow to the Discrete Models
Mohammad Quasem, Howard University

Finite Buffer Fluid Models with Overflow Protection: Applications in Queueing Models
Liqiang Liu, Eindhoven University of Technology

Map Segmentation Algorithms for Geographic Resource Allocation
John Carlsson, University of Minnesota

Decision Support System at AMD: OARS
Mehmet Candas, AMD

Workload Crisis Management in Knowledge-Based Service Systems
Yao Cheng, Northwestern University

Informational Social Influences on B2C E-commerce Websites
Lih-Bin Oh, Xi'an Jiaotong University

TUESDAY

Case Study for Analysis of the Cost Change in Construction Risk Management
Omer Faruk Baykoc, Gazi University

Framework for Estimation of Configurable Product Substitution Rates in Auto Markets
Dingzhou Cao, Wayne State University

A Hybrid Metaheuristic Approach to Design of Reliable Networks
Fulya Altiparmak, Gazi University

Manufacturing and Remanufacturing Aggregate Planning Model with a Non-linear Supply Function
Jordi Olivella, Technical University. of Catalonia

A Proposed Knowledge Sharing Platform
Albert Cruz, National University

BioDE: A Novel Differential Evolution Approach for Molecular Conformational Search
Athina Brintaki, University of South Florida

HOPSPACK Software Framework for Parallel Derivative-free Optimization
Todd Plantenga, Sandia National Laboratories

Large Problems and Small Problems
Mark Spearman, Factory Physics, Inc.

Large-Scale Evacuation of Carless People: A Tabu Search Algorithm for Bus Routing Problem
Chi Pak Chan, Univ. of Arizona

Model-based and Optimizing Design Methodology for Production Systems
Petri Eskelinen, Univ. of Jyväskylä

Analysis of Scheduling for Virtual Manufacturing Cells: Batch Splitting
Zulal Gungor, Gazi University

Optimizing Screening for Colorectal Cancer Prevention and Surveillance
Fatih Safa Erenay, University of Wisconsin Madison

Planning Tools for Program Management in a Supply Chain Context
Suri Gurumurthi, Duke University

Potential of Multi-player Agent-based Simulations in Modeling of Complex Service Systems
Natalie Simpson, University at Buffalo

Observability and Sensor Placement for Advanced Power Systems
Adrian Lee, University of Illinois

Modeling the Physician Preference Item Supply Chain
Cara Dienes, Iowa State University

Physiological Aspects of Load Encumbrance in an Agent-based Force-on-force Constructive Simulation
Mitha Andra, Technology Solutions Experts, Inc.

AMHS Scheduling in Semiconductor Manufacturing
Emrah Zarifoglu, University of Texas-Austin

Markovi: Interactive Approach to Learning Markov Chain Analysis
Daniel Silva, Kimberly Clark Corp.

Sum of Squares and Polynomial Convexity
Amir Ali Ahmadi, MIT

Research Agenda on Integrated Hospital Material Management
Vesa Kamarainen, Helsinki University of Technology

Empirical Study on IT-enabled Supply Chain Value Co-creation
Yao Zhang, Georgia Institute of Technology

New Preference Models & Optimization Methods for Complex Decision Problems with Multiple Criteria
Alexander Engau, University of Colorado Denver

Translating Inventions into Products: Inventors' Educational Background and Speed of Licensing
Ayfer Ali, Harvard University

Simulation and Optimization of Nurse-to-Patient Assignments
Durai Sundaramoorthi, Missouri Western State Univ.

Post Optimization in Multiple Crew Scheduling Problems
Konrad Borys, Sabre

Pattern-based Analysis of Supply Chain Collaboration: Business Process Perspective
Zhe Shan, Penn State University

Stochastic Location Model for Hurricane Relief
Desiree Tejada-Calvo, Florida International Univ.

Process Standardization in Services Outsourcing
Bryon Balint, Carnegie Mellon University

Emergency Shelter Location and Resource Allocation
Sara Ghorbani, Rutgers University

Approach to Renovation Task Sequencing with Multi-criteria Objectives
Steven Yuhaski, Jr., Natick R&D and Engineering Center

Addressing Sources of Uncertainty in Strategic Fire Planning
Matt Thompson, USDA Forest Service

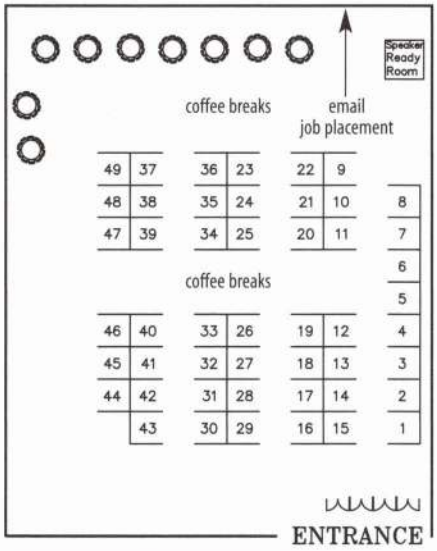
Credit Risk Portfolio Optimization
Oleksandr Romanko, McMaster University

Integrated Dispatching Problem in Container Terminals
Yuan Wang, National Univ. of Singapore

Supply Chain Optimization for the World Food Program
James Wade, Georgia Institute of Technology

SAN DIEGO CONVENTION CENTER

Exhibit Hall H



Coffee breaks will be held in the Exhibit Hall.

Exhibits Open

Sunday, Oct. 11	12:00pm-5:00pm 7:30pm-9:00pm (Welcome Reception)
Monday, Oct. 12	9:00am-5:00pm
Tuesday, Oct. 13	9:00am-5:00pm
Wednesday, Oct. 14	9:00am-1:00pm

FREE Wireless Internet in Exhibit Hall!

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AORDA consults on risk management, optimization and statistics, and develops advanced optimization software. Portfolio Safeguard is AORDA's optimization package for risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (linear, quadratic, maximum, probability, VaR, CVaR, cardinality, fixed-charge, etc.). Real-life case studies in Windows, MATLAB, C++, Run-File.

AMPL Optimization LLC **#11**
900 Sierra Place SE
Albuquerque, NM 87108-3379
www.ampl.com
AMPL Optimization LLC develops and supports the AMPL modeling language, the most powerful and natural tool for working with the large, complex optimization problems that arise in diverse applications. AMPL is notable for supporting a broad variety of linear and nonlinear problem formulations as well as over 30 varied large-scale solvers.

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www.anylogic.com
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COIN-OR **#45**
www.coin-or.org
Visit the Computational Infrastructure for Operations Research booth to learn about free, open-source tools for OR professionals and students. COIN-OR is in its ninth year as a community initiative to build an open infrastructure of algorithms, models, data and other digital tools. COIN-OR is hosted online by INFORMS and is a strategic partner of the INFORMS Computing Society.

Dynamic Ideas **#9**
43 Lantern Rd.
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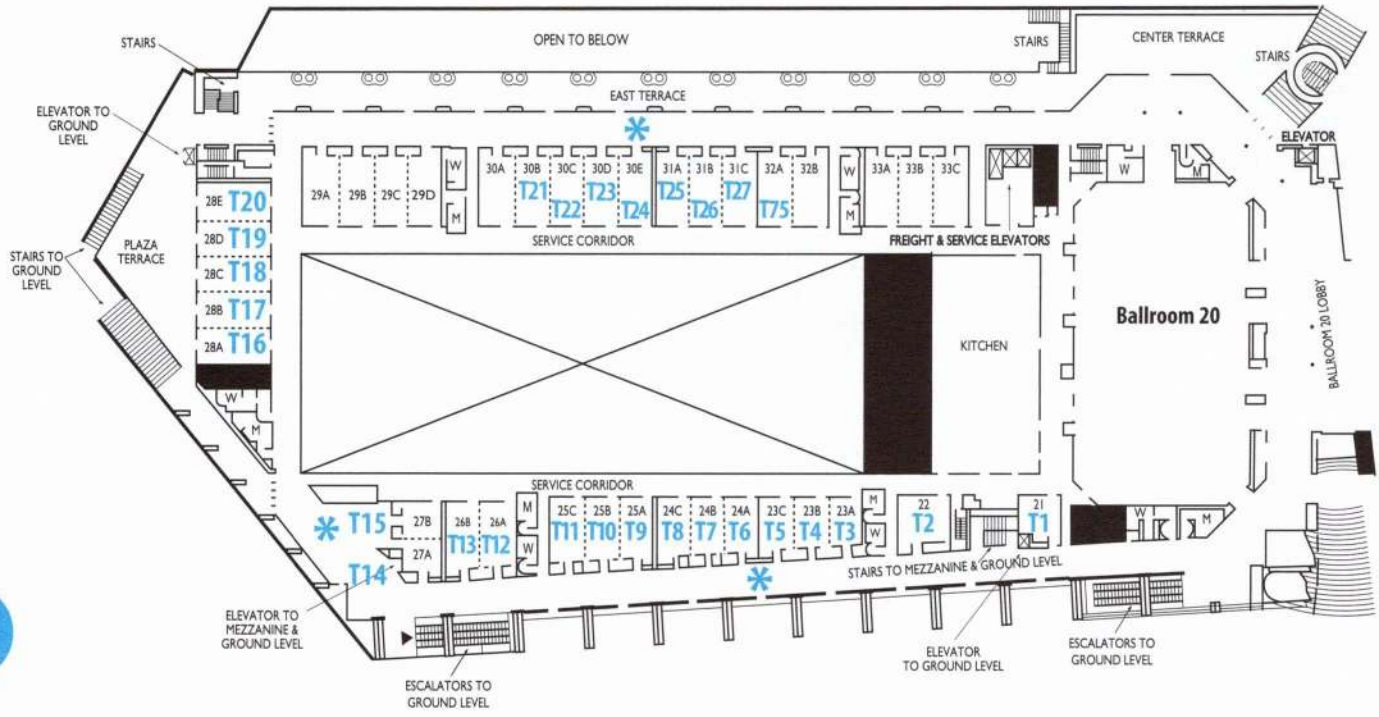
* Session Monitor Desk

UPPER LEVEL

TRACKS
1-27, 75

Track numbers shown for Technical Session Rooms



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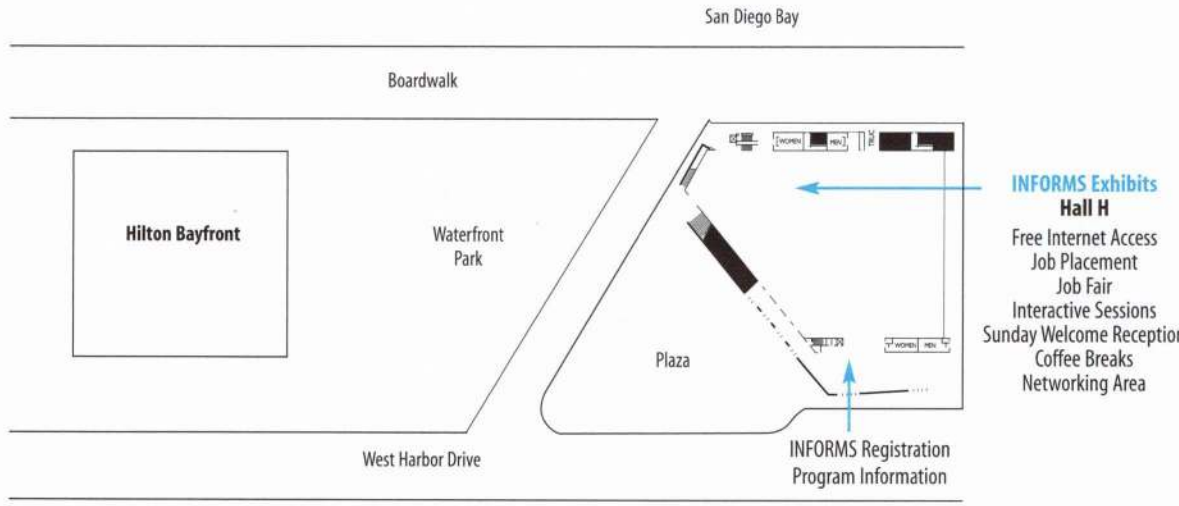


Auctions
Elena Katok
Pennsylvania State University

Damian Beil
University of Michigan

Daniel H. Wagner Prize for Excellence in Operations Research
Allen Butler
Daniel H. Wagner Associates, Inc.

Data Envelopment Analysis
Lawrence Seiford
University of Michigan

Doing Good with Good OR Student Competition
Ozlem Ergun
Georgia Institute of Technology

Cynthia Barnhart
Massachusetts Institute of Technology

Economic Models in Operations Management
Saibal Ray
McGill University

Haresh Gurnani
University of Miami

Financial Engineering
Erhan Çinlar
Princeton University

Game Theory
Asu Ozdaglar
Massachusetts Institute of Technology

George B. Dantzig Dissertation Prize
M. Eric Johnson
Dartmouth College

Global Sourcing of Services
Natalia Levina
New York University

Grassroots PR for Operations Research
Barry List
INFORMS

Green Supply Chain
Mark Ferguson
Georgia Institute of Technology

Gilvan Souza
University of Maryland

Homeland Security and Counterinsurgency
Moshe Kress
Naval Postgraduate School

Roberto Szechtman
Naval Postgraduate School

Hospitality
Gary M. Thompson
Cornell University

Interior Point Methods (25th Anniversary of IPM)
Samuel Burer
University of Iowa

Uday Shanbhag
University of Illinois at Urbana-Champaign

Ted Ralphs
Lehigh University

Inventory Management
Tamer Boyaci
McGill University

Ozalp Ozer
Columbia University

Job Placement Services
Talisa Murray
Johns Hopkins University

Large Scale Optimization (In Honor of Jean-Louis Goffin)
Mohammad Oskoorouchi
California State University-San Marcos

Samir Elhedhli
University of Waterloo

Managing Disruptions in Supply Chains
Kathryn E. Stecke
University of Texas-Dallas

Sanjay Kumar
Pennsylvania State University

Thomas Schmitt
University of Washington

Multi-Criteria Decision Making
Asim Roy
Arizona State University

New Product Development
Sanjiv Erat
University of California-San Diego

Thomas Roemer
University of California-San Diego

Nicholson Student Paper Prize
Michael Ferris
University of Wisconsin

Operations Management/Marketing Interface
Kathryn E. Stecke
University of Texas-Dallas

Xuying Zhao
University of Notre Dame

OR in Biomedicine & Global Health
Eva K. Lee
Georgia Institute of Technology

OR/MS with Societal/Humanitarian Impact
Pinar Keskinocak
Georgia Institute of Technology

Ozlem Ergun
Georgia Institute of Technology

Julie Swann
Georgia Institute of Technology

Project Management
Theodore Klastorin
University of Washington

Queueing Models
Otis Jennings
Duke University

Scheduling
Marc E. Posner
Ohio State University

Nicholas G. Hall
Ohio State University

Service Operations Management
Rohit Verma
Cornell University

Supply Chain Models
Kevin H. Shang
Duke University

Theory, Algorithms & Applications of Convex Cone
Miguel Anjos
University of Waterloo

Henry Wolkowicz
University of Waterloo

Workforce Management
Esma Gel
Arizona State University

Yun Fong Lim
Singapore Management University

FUTURE *Meetings*

INFORMS MEETINGS

2010

April 18-20
INFORMS Practice Conference:
Applying Science to the Art of Business
Hilton Bonnet Creek
Orlando, Florida
Chair: William Klimack, Decision Strategies, Inc.
www.informs.org/Conf/Practice2010

June 6-9
ALIO-INFORMS International
Law School, Univ. of Buenos Aires
Buenos Aires, Argentina
Chair: Irene Loiseau, University of Buenos Aires
http://meetings.informs.org/BuenosAires2010

November 7-10
INFORMS Annual Meeting 2010 Austin
Austin Convention Center and Hilton Austin
Austin, Texas
Chair: Jonathan Bard, University of Texas at Austin
jbard@mail.utexas.edu

2011

November 13-16
INFORMS Annual Meeting 2011 Charlotte
Charlotte Convention Center
Charlotte, North Carolina
Chair: Cem Saydam, University of North Carolina at Charlotte
saydam@uncc.edu

2012

Dates to be Announced
INFORMS International Beijing
In conjunction with the Operations Research Society of China
Beijing, China
Chair: Jian Chen, Tsinghua University
jchen@mail.tsinghua.edu.cn

October 14-17
INFORMS Annual Meeting 2012 Phoenix
Phoenix Convention Center
Phoenix, Arizona
Chair: Ronald Askin, Arizona State University
ron.askin@asu.edu

INFORMS COMMUNITIES

2009

December 13-16
Winter Simulation Conference 2009
Hilton Austin
Austin, Texas
Chair: Ann Dunkin
www.wintersim.org

2010

May 5-7
INFORMS Telecommunications Conference
Concordia University
Montreal, Canada
Chair: Brigitte Jaumard, Concordia University
bjaumard@ciise.concordia.ca

June 16-19
INFORMS Marketing Science Conference
Maritim Hotel Cologne
Cologne, Germany
Werner Reinartz, University of Cologne
http://www.marketingscience2010.uni-koeln.de/01/index.asp

December 5-8
Winter Simulation Conference 2010
Marriott Inner Harbor
Baltimore, Maryland
Chair: Joe Hugan, Forward Vision
jhugan@forwardvision.com

July 10-15
IFORS Triennial 2011
Melbourne Convention Center
Melbourne, Australia
Chair: Patrick Tobin, Australian Catholic University
http://www.ifors2011.org/

How to Navigate the Technical Sessions

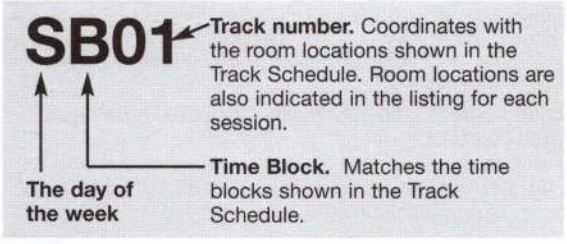
There are three primary resources to help you understand and navigate the Technical Sessions:

- 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 Session Chair, Author, and Session indices provide cross-reference assistance (pages 426-463).
- The Track Schedule is on pages 46-53. This is an overview of the tracks (general topic areas) and when/where they are scheduled.

Quickest Way to Find Your Own Session

Use the Author Index (pages 430-453) — the session code for your presentation(s) will be shown along with the track number. You can also refer to the full session listing for the room location of your session(s).

The Session Codes



Time Blocks

Sunday-Thursday

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 -	1:45pm – 2:15pm
D -	2:45pm - 4:15pm
E -	4:30pm - 6:00pm

Room Locations/Tracks

All tracks and technical sessions will be held in the Hilton San Diego Bayfront and the San Diego Convention Center. Room numbers are shown on the Track Schedule and in the technical session listing.

Sunday, 8:00am - 9:30am

■ SA01

C-Room 21, Upper Level

Panel Discussion: The Society of Decision Professionals - Building a True Profession

Sponsor: Decision Analysis
Sponsored Session

Chair: Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

1 - The Society of Decision Professionals - Building a True Profession

Moderator: Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com, Panelist: Larry Neal, David Leonhardi, Hannah Winter, Jack Kloeber, Andrea Dickens

When we take stock of 40 years of Decision Analysis practice. Decision professionals still assist in only a small fraction of important and difficult choices. In this panel, practitioners will explore why this is the case and discuss how to form a true profession to transform the way important and difficult decisions are made.

■ SA02

C-Room 22, Upper Level

Joint Session DA/HAS:Decision Analysis in Health Applications

Sponsor: Decision Analysis & Health Applications
Sponsored Session

Chair: Israel David, Professor, Ben-Gurion University, 14/38 Rahavat-Ilan Street, Givat-Shmuel, Israel, idavid@bgu.ac.il

1 - The Search for Compatible Kidneys for Transplantation - A Handy Research and Decision Aid

Israel David, Professor, Ben-Gurion University, 14/38 Rahavat-Ilan Street, Givat-Shmuel, Israel, idavid@bgu.ac.il, Michal Moatty-Assa

We study the prospects of patients for kidney transplant and their optimal acceptance-rejection policy for varying-quality tissue matching. We present a computational tool to calculate the probabilities of present-day relevant HLA mismatches, and the optimal policy in terms of critical times. The accompanied Excel software may serve both the surgeon and the organizer of a donation program. Its use sheds light on debated issues such as race discrimination in unrelated-donor organ transplantation.

2 - Decision Making Methodology for the Budget Impact Analysis of Breast Cancer Screening Strategies

Luis Hernandez, BSc, MSc Candidate, Universidad de Los Andes, Calle 100 #49-85 Bloque 2 Apt. 402, Bogota, Colombia, gabr-her@uniandes.edu.co, Mario Castillo

This work develops a decision analysis methodology to evaluate the budget impact of the introduction and diffusion of a new health technology in a health care system formulary. This methodology is supported in a flexible and innovator Excel model, according to all international recommendations and guidelines. The methodology was applied to a real case in Colombia and it can be adapted to other disease areas and health technologies.

3 - Pharmaceutical Marketing Decision under a Price-volume Agreement

Hui Zhang, Assistant Professor, Lakehead University, 955 Oliver Rd., Thunder Bay, ON, P7B5E1, Canada, hzhang2@lakeheadu.ca, Greg Zaric

Pharmaceutical marketing, which includes physician detailing and direct-to-consumers advertising, will promote drug sales but may decrease its health benefit on patients. Price-volume agreements, in which the manufacturer returns to the payer a portion of sales exceeding a volume threshold, have emerged as a way to manage this issue. We develop a principal-agent model to derive the optimal marketing decision with the volume threshold is determined by the payer or by the manufacturer.

■ SA03

C-Room 23A, Upper Level

Game Theory and Computational Economics I

Cluster: Game Theory
Invited Session

Chair: Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu

Co-Chair: Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu

1 - The Linear Programming Approach to Solving Large Scale Dynamic Oligopoly Models

Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu, Denis Saure, Vivek Farias

Dynamic oligopoly models are used in industrial organization and the management sciences to analyze diverse dynamic phenomena. The computational complexity of solving for the equilibrium has severely limited the applicability of these models. We introduce approximation methods based on the LP approach to approximate dynamic programming that dramatically reduce the computational complexity. Our methods greatly increase the set of dynamic oligopoly models that can be analyzed computationally.

2 - Pricing with Markups under Horizontal and Vertical Competition

Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu, Jose Correa, Roger Lederman

We model a market for a single product that may be composed of sub-products that face horizontal and vertical competition. Each firm, offering all or some portion of the product, adopts a price function proportional to its costs by deciding on the size of a markup. Customers then choose a set of providers that offers the lowest total cost. We characterize equilibria of the two-stage game and study the efficiency resulting from the competitive structure of the market.

3 - Markov Perfect Equilibria in Stochastic Games

Matthieu Monsch, MIT, 70 Pacific St, Apt 586B, Cambridge, 02139, United States of America, monsch@mit.edu, Georgia Perakis, Vivek Farias

Computation of closed-loop equilibria in dynamic pricing games under fixed capacity is a hard problem. We study Markov Perfect Equilibria (MPE) in finite horizon discrete-time stochastic games. We show how Best Response dynamics converge to an MPE for linear demand. We suggest a natural dynamic that converges under mild assumptions to an MPE that capture a large class of nonlinear functions.

4 - Comparing Multilateral and Bilateral Exchange Models for Content Distribution

Ramesh Johari, Atanford University, ramesh.johari@stanford.edu, Christina Aperjis, Michael J. Freedman

Peer-assisted content distribution matches user demand for content with available supply at other peers in the network. Inspired by this supply-and-demand interpretation of the nature of content sharing, we employ price theory to study peer-assisted content distribution. We rigorously analyze the efficiency and robustness of price-based multilateral exchange, and compare and contrast multilateral content exchange with bilateral exchanges such as BitTorrent.

■ SA04

C-Room 23B, Upper Level

Combinatorial Auctions in the Lab

Cluster: Auctions
Invited Session

Chair: Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, martin.bichler@in.tum.de

1 - An Experimental Comparison of Iterative Combinatorial Auction Formats

Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, martin.bichler@in.tum.de, Pasha Shabalin, Georg Ziegler, Tobias Scheffel

Combinatorial auctions are used for the efficient allocation of heterogeneous goods. Several promising iterative combinatorial auction formats have been developed. In this talk, we provide the results of lab experiments testing these different auction formats in the same setting. We analyze aggregate metrics, such as efficiency and auctioneer revenue for small and medium-sized value models as well as individual bidding behavior.

2 - On the Exposure Problem in Large Spectrum Auctions

Jacob Goeree, California Institute of Technology, Pasadena, CA, 91125, United States of America, jacob.goeree@gmail.com, Yuanchuan Lien

We analyze the dynamic simultaneous ascending auction (SAA) and a sealed-bid variant (SSA). In both formats, competition takes place on an item-by-item basis, which creates an exposure problem. When competing aggressively for a package, a bidder may incur a loss when winning only a subset. We characterize the Bayes-Nash equilibria for SSA and SAA. With many licenses for sale the SAA generates efficient outcomes. This surprising result provides an important justification for its widespread use.

3 - A Data-driven Exploration of Bidder Behavior in Continuous Combinatorial Auctions

Alok Gupta, University of Minnesota, United States of America, agupta@csom.umn.edu, Shawn Curley, Pallab Sanyal, Gedas Adomavicius

Computational and cognitive complexity in Combinatorial Auctions has prevented this mechanism from reaching the online marketplace. Our study uses a data-driven approach to explore bidder behavior in such auctions using three experimental treatments that differ in the type of information feedback provided to participants. The enumeration of the strategies along with the analysis of their financial implications will help practitioners design better combinatorial auction environments.

■ SA05

C-Room 23C, Upper Level

Advancements in Data Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Rajesh Ganesan, Assistant Professor, George Mason University, 4400 Univ Dr. MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu

1 - Characterization of Nonlinear Profiles Variation Using Mixed-effect Models and Wavelets

Kamran Paynabar, University of Michigan, 2292, Stone road, Ann Arbor, Ann Arbor, United States of America, kamip@umich.edu, Judy Jin

Nonparametric methods such as Wavelets have been effectively used in nonlinear profile monitoring. Traditionally, the profile variability is often modeled by i.i.d. random noises. Differently, this research considers both within- and between-profiles variations using a mixed effect model of transformed wavelet features. A change-point model is applied to ensure the identicalness of the profiles distribution. Finally, the performance of the model is evaluated using simulation and a case study.

2 - Function Approximation: A Quality Comparison Between Different Methods

Rajesh Ganesan, Assistant Professor, George Mason University, 4400 Univ Dr. MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu

The talk presents a comparison between different known methods and diffusion wavelets for function approximation of multidimensional data. Computational complexity and mean square error performance metrics are compared.

■ SA06

C-Room 24A, Upper Level

Decision Analysis and Risk Management

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Tianyang Wang, McCombs School of Business, The University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@phd.mccombs.utexas.edu

1 - The Correlated Multivariate Decision Tree

Tianyang Wang, McCombs School of Business, The University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@phd.mccombs.utexas.edu, James Dyer

There is a growing need for the ability to specify and generate correlated random variables as primitive inputs to stochastic models. This paper presents a correlated decision tree model allowing multiple correlated uncertainties with arbitrary marginal distributions. Compared to the alternative copulas-based approach, the proposed correlated decision tree model presents a computationally efficient and standardized method for multivariate decision and risk analysis.

2 - An Informative Initial Sample Approach to Active Fraud Detection

Jing Ai, The University of Hawaii at Manoa, Shidler College of Business, 2404 Maile Way C305, Honolulu, HI, 96822, United States of America, jinga@hawaii.edu, Maytal Saar-Tsechansky

This paper proposes a new active learning method using an "informative" initial training sample pre-selected by an unsupervised method. By using an "informative" initial sample rather than a random initial sample, this new

method could lead to better learning performance and "front-loaded" cost savings. This method is especially pertinent to applications such as fraud detection, where a random initial sample tends to be biased and needs to be obtained at a substantial cost.

3 - Simulating Non-stationary, Non-Poisson, Non-renewal Arrival Processes

Barry L Nelson, Professor, Northwestern University, Department of Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu, Ira Gerhardt

Every simulation software product includes renewal arrival processes, and many support non-stationary Poisson arrivals. But real arrival processes can be non-stationary, non-Poisson and non-renewal. We present a convenient framework for fitting and simulating arrival processes that may have time-dependent arrival rates, may be more variable or more regular than a Poisson process, and may exhibit dependence among arrivals.

4 - Algorithms for Poisson and Negative Binomial Random Vector Generation

Raghu Pasupathy, Assistant Professor, Virginia Tech, 221 Durham Hall, Blacksburg, VA, 24061, pasupath@vt.edu, Kaeyoung Shin

We present fast algorithms for Poisson random vector generation. These algorithms have complete coverage in two dimensions, and rigorous error control for robust implementation. Furthermore, they have demonstrably faster preprocessing and generation times compared to NORTA. We will also discuss simple extensions for generating negative binomial random vectors through a well-known transformation that uses the gamma distribution.

5 - Multivariate Inputs with Time-varying Distributional Properties

Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu, Jim Foster

Although the joint distributional properties of multivariate time-series input processes often vary with time, most of the simulation input models have been developed for stationary processes. We present a model for input processes with possibly many components having time-varying joint distributional properties. This model further generalizes some of the well-known conditional heteroskedastic models used routinely for financial time-series modeling.

■ SA07

C-Room 24B, Upper Level

Data Mining Algorithms for Parsimonious Modeling

Sponsor: Data Mining
Sponsored Session

Chair: Seoung Bum Kim, Assistant Professor, Korea University, Anam-dong Seongbuk-Gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

1 - How to Integrate the Diverse Measures for Hospital Fraud Detection?

Hyunjung Shin, Assistant Professor, Ajou University, Suwon, Korea, Republic of, shin@ajou.ac.kr, Junwoo Lee

To detect fraudulent and abusive bill claims of medical care providers, a variety of indexes have developed and evaluated diverse aspects of bill claim pattern. When taking all of indexes into consideration, however, it becomes confusing to find out which index is of more importance than others, and even more difficult if the respective results are significantly discordant. To avoid the ambiguities, we propose a method integrating the diverse degrees of anomaly based on 2007 Korean HIRA data.

2 - A One-class Classification Based Fault Isolation Method for Multivariate Process Diagnosis

Thuntee Sukchotrat, Research Faculty, University of Texas at Arlington, United States of America, thuntee.sukchotrat@mavs.uta.edu, Seoung Bum Kim

A number of fault isolation methods have been developed to identify the contribution of alarms signaled from multivariate control charts. However, most of them require a distributional assumption that restricts their applicability to a wide range of problems. To overcome such limitation, we propose a nonparametric fault isolation approach that decomposes the monitoring statistics obtained from a one-class classification algorithm into components that reflect the contribution of each variable.

3 - Unsupervised Feature Selection Using Weighted Principal Components

Panaya Rattakorn, PhD Candidate, University of Texas at Arlington, Arlington, TX, United States of America, panaya.rattakorn@mavs.uta.edu, Seoung Bum Kim

We proposed an unsupervised feature selection method that combines weighted principal components (WPCs) with thresholding algorithms. Each coefficient of the WPCs represents the importance of each individual feature. To identify the significant coefficients, we proposed two thresholding algorithms: a recursive thresholding algorithm and a bootstrap thresholding algorithm. Our experimental results with simulated data and real datasets demonstrated the effectiveness of the proposed methods.

4 - PCA-Based Feature Selection Method for NDP Approximation to the CRL Scheduling Problem

Jin Young Choi, Assistant Professor, Ajou University, Suwon, Korea, Republic of, choijy@ajou.ac.kr, Seoung Bum Kim

We present a principal component analysis (PCA)-based feature selection method for the neuro-dynamic programming (NDP) approximation to the capacitated re-entrant line scheduling problem. In particular, the PCA-based feature selection method is examined for its potential efficacy of the approximation by generating some example capacitated re-entrant lines.

■ SA08

C-Room 24C, Upper Level

High Dimensional Variable Selection with L1 Type Penalties

Sponsor: Data Mining
Sponsored Session

Chair: Gareth James, Associate Professor, University of Southern California, 522 Hoffman Hall, Information and Operations Management, Los Angeles, CA, 90089, United States of America, gareth@usc.edu

1 - Algorithms for Very Large Scale L1 Minimization and Related Problems

Emmanuel Candes, CalTech, emmanuel@acm.caltech.edu, Jerome Bobin, Stephen Becker

This talk introduces novel algorithms for L1 minimization and other nonsmooth norms such as the nuclear norm. These algorithms are based on ideas from Nesterov, namely, accelerated descent methods and smoothing techniques. We demonstrate the effectiveness of these methods on several examples taken in a variety of different fields.

2 - Forward-LASSO with Adaptive Shrinkage

Peter Radchenko, Assistant Professor, University of Southern California, Los Angeles, CA, Peter.Radchenko@marshall.usc.edu, Gareth James

Both Forward Selection and the Lasso provide computationally feasible methods for performing variable selection in high dimensional regression problems involving many predictors. We propose a new method we call Forward-Lasso Adaptive Shrinkage (FLASH), which incorporates the two approaches as special cases. We provide theoretical justifications and also demonstrate on an extensive set of simulations that FLASH generally outperforms many competing approaches.

3 - A Unified Approach to Model Selection and Sparse Recovery Using Regularized Least Squares

Jinchi Lv, Assistant Professor, University of Southern California, IOM Department, HOH 504, University of Southern California, Los Angeles, CA, 90089, United States of America, jinchilv@marshall.usc.edu, Yingying Fan

In this paper we study the properties of regularization methods in model selection and sparse recovery under the unified framework of regularized least squares (RLS) with concave penalties. For model selection, we establish conditions under which a RLS estimator enjoys the nonasymptotic weak oracle property, where the dimensionality can grow exponentially with sample size. For sparse recovery, we present a sufficient condition that ensures the recoverability of the sparsest solution.

4 - Partial Correlation Estimation by Joint Sparse Regression Models

Ji Zhu, Associate Professor, University of Michigan, 439 West Hall, 1085 South U Ave, Ann Arbor, MI, 48109, United States of America, jizhu@umich.edu

In this talk, we propose a computationally efficient approach for selecting non-zero partial correlations under the high-dimension-low-sample-size setting. This method assumes the overall sparsity of the partial correlation matrix and employs sparse regression techniques for model fitting. It is shown that our method performs well in both non-zero partial correlation selection and the identification of hub variables, and also outperforms two existing methods.

■ SA09

C-Room 25A, Upper Level

Analysis of Multi-server and Non-stationary Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Natarajan Gautam, Texas A&M University, 3131 TAMU, 235A Zachry, College Station, TX, 77843, United States of America, gautam@tamu.edu

1 - Large Scale Dynamics for Multi-server Queues with Abandonment
William Massey, wmassey@Princeton.EDU, Rudy Horne, Avishai Mandelbaum

The fluid and the diffusion models for a multi-server queue with abandonment arise as uniform asymptotic scalings of the time-varying Poisson arrival rate and the number of servers. The fluid model is a one-dimensional, non-linear dynamical system. When the diffusion is a Gaussian process, then its variance coupled with the fluid model forms a two-dimensional dynamical system. We study these dynamics to characterize the time-varying behavior of the multi-server queue.

2 - Heavy-traffic Extreme-value Limits for Erlang Models
Ward Whitt, Professor, Columbia University, 500 West 120th Street 313 Mudd, New York, NY, 10027, United States of America, ww2040@columbia.edu, Guodong Pang

We consider the maximum queue length and the maximum number of idle servers in the Erlang delay model and the generalization allowing customer abandonment. We use strong approximation to show, under regularity conditions, that properly scaled versions of them converge jointly to independent random variables with the Gumbel distribution in the QED and ED regimes as n and t increase to infinity together appropriately.

3 - Ph_t/M_t/s/c Time-Dependent Departure Process and Queues in Tandem
Michael Taaffe, Associate Professor, Virginia Tech, 209 Durham Hall, Blacksburg, VA, 24061, taaffe@vt.edu, Walid Nasr

We approximate the time-dependent moments of the number-in-system for tandem queues having M_t service and Ph_t exogenous arrival processes. We develop partial-moment differential equations and closure approximations for the time-dependent departure-count moments for the upstream node and then fit the departure-count moments of the upstream node to an approximate \widetilde{Ph_t} process to be used as the approximate arrival process to the downstream node.

4 - Performance Analysis of Multi-server Non-stationary Queueing Systems
Young Myoung Ko, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ymko@tamu.edu, Natarajan Gautam

We consider non-stationary multi-server queueing systems. An asymptotic method called "strong approximation" can be easily applied to various types of systems thanks to its generality. It, however, requires a strong assumption that is usually not satisfied in many multi-server queueing systems. To address this limitation, we develop a new method by enhancing the strong approximations and achieve better accuracy preserving its versatility.

■ SA10

C-Room 25B, Upper Level

Stochastic Networks and Related Processes

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Associate Professor, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, jhas@mail.utexas.edu

1 - Heavy Traffic Limits for G/G/1 SRPT Queues
Amber Puha, Associate Professor, California State University San Marcos, Department of Mathematics, 333 S. Twin Oaks Valley Road, San Marcos, CA, 92096, United States of America, apuha@csusm.edu, H. Christian Gromoll, Lukasz Kruk

We present a heavy traffic analysis for a G/G/1 queue in which the server uses the shortest remaining processing time (SRPT) policy. We prove heavy traffic limit theorems for a measure-valued state descriptor processes.

2 - Reflected Brownian Motion in Three Dimensions: Tail Behavior of the Stationary Distribution
J. Michael Harrison, Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, harrison_michael@GSB.Stanford.Edu

Let Z be a three-dimensional Brownian motion confined to the non-negative orthant by oblique reflection at the boundary. Necessary and sufficient conditions are known for Z to be a positive recurrent semimartingale. Assuming only those conditions, a large deviations principle (LDP) is conjectured for the stationary distribution of Z, and a simple method is described for computing the associated rate function.

3 - Queueing Systems with Finite Arrivals
Yu Wang, University of Minnesota, Indutrial and Systems Engineering, Minneapolis, MN, 55455, wang1075@umn.edu, Oualid Jouini, Saif Benjaafar

Motivated by applications with a distinct rush hour regime, we consider queueing systems where the number of arrivals is finite but inter-arrival times are non-identically distributed. We characterize the distribution of number of customers in the system and obtain several delay-related performance measures. We show how ignoring either the finiteness in the number of arrivals or the heterogeneity in inter-arrival times can lead to significant errors in evaluating these performance measures.

■ SA11

C-Room 25C, Upper Level

Port Security and Nuclear Interdiction

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W. Main Street, Box 843083, Richmond, VA, 23084, United States of America, lamclay@vcu.edu

1 - An Efficient Branching Scheme for the Stochastic Network Interdiction Problem
Mike Nehme, mikenehme@yahoo.com, David Morton

We describe a stochastic network interdiction model for deploying radation detectors at border checkpoints to detect smugglers of nuclear material. While the problem is NP-Complete in the general case, we can compute wait-and-see bounds in polynomial time if we are only allowed to install detectors at checkpoints of the origin and destination countries. These bounds augment a scheme which heuristically identifies critical subsets of smuggler paths and branches on which subsets are interdicted.

2 - A Systems Concept for Detecting Nuclear Materials
Gary Gaukler, TAMU, TAMU-3131, College Station, United States of America, gaukler@tamu.edu, Yu Ding, Chenhua Li

In this talk, we discuss a layered container inspection system for detecting illicit nuclear materials. A key contribution of this inspection system is the incorporation of sensor measurements at checkpoints that the container previously visited. We present an inspection policy structure and evaluate the impact of prior checkpoint information on system performance.

3 - Optimal Test Management through Dynamic Programming
Endre Boros, Professor, Rutgers University, boros@rutcor.rutgers.edu, Paul Kantor

Many constraints in optimal detection are linear, indexed by the path that a particular item follows through the screening tree. Adapting thresholds in subsequent tests, based on the results of earlier ones, yields optimal detection at a given cost. For stochastically independent tests, Dynamic Programming yields further dramatic computational improvements. The algorithms have been implemented in highly efficient Java code. Supported by DNDO and ONR.

4 - Risk-Based Policies for Detecting Nuclear Material on Cargo Containers
Rebecca Dreiding, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave, Richmond, VA, 23284, United States of America, dreidingra@vcu.edu, Jason Merrick, Laura McLay

We introduce a framework for screening cargo containers for nuclear material at security stations throughout the United States using knapsack problem models. The approach investigates how to define a system alarm given a set of screening devices, given a multi-layered prescreening system. Containers that yield a system alarm undergo secondary screening, where more effective and intrusive screening devices are used to further examine containers for nuclear material.

■ SA12

C-Room 26A, Upper Level

Computational Issues in Approximate Dynamic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Warren Powell, Professor, Princeton University, Sherrerd Hall 230, Princeton, NJ, 08544, United States of America, powell@princeton.edu

1 - Ambulance Redeployment

Shane Henderson, Professor, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Matthew Maxwell, Huseyin Topaloglu

Ambulance redeployment, or system status management, involves relocating ambulances in real time in an attempt to minimize the fraction of calls with large response times. We present an update on our work in using approximate dynamic programming for ambulance redeployment.

2 - Convergent Least Squares Policy Iteration Algorithm for High-Dimensional Markov Decision Process

Jun Ma, Princeton University, Dept of Operations Research and Fin Engg, Princeton, NJ, 08544, United States of America, junma@princeton.edu

In this paper we propose a least squares policy iteration algorithm for infinite-horizon Markov decision problems where the state and action spaces are continuous and the expectation cannot be computed exactly. We show that, under certain problem structure assumptions on value functions, the algorithm converges in the mean, meaning that the mean error between the approximate policy value function and the optimal value function shrinks to zero as successive approximations become more accurate.

3 - Robust Design of Global Supply Chains

Linda Nozick, Professor, Cornell University, Ithaca, NY, 14853, United States of America, lkn3@cornell.edu, Ningxiong Xu

As supply chains become more and more dependent on the efficient movement of materials among facilities that are geographically dispersed there is more opportunity for disruption. One of the common disruptions is the loss of production capability at supplier sites. We formulate a two-stage stochastic program and a solution procedure to optimize supplier selection to hedge against these disruptions.

4 - Hierarchical Knowledge Gradient for Sequential Sampling

Martijn Mes, Professor, University of Twente, School of Management and Governance, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.r.k.mes@utwente.nl, Warren Powell, Peter Frazier

We consider the problem of selecting the best of a finite but large set of alternatives. We propose a hierarchical sequential sampling policy based on the knowledge-gradient policy. This policy optimizes the expected increment in the value of sampling information in each time period at various aggregation levels and uses the common features shared by alternatives to learn about many alternatives from even a single measurement. We demonstrate how this hierarchical knowledge-gradient policy can be applied to efficiently maximize a continuous function and prove that this policy finds a globally optimal alternative in the limit.

■ SA13

C-Room 26B, Upper Level

Infrastructure Management/Analysis

Sponsor: Computing Society
Sponsored Session

Chair: Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov

1 - Optimizing Transformation of the United States Nuclear Weapons Infrastructure

Carol Meyers, Applied Mathematician, Lawrence Livermore National Laboratory, 7000 East Avenue, L-153, Livermore, CA, 94550, United States of America, meyers14@llnl.gov, Victor Castillo, Clifford Shang

The US nuclear weapons complex has undergone substantial consolidation in the last 30 years, including the closure of over 40% of all nuclear production and testing sites. Moreover, the National Nuclear Security Administration has pledged a further 30% reduction in the square footage of remaining facilities. We discuss mixed integer programming models we have developed to help optimize this transformation process, both in terms of infrastructure and the composition of the future stockpile.

2 - Nonlinear Sensor Placement Problems for Contamination Warning Systems

William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, wehart@sandia.gov, Cynthia Phillips, Regan Murray

Reliable, clean water is critical for maintenance of public health, protection of public infrastructure and the operation of key industries. A critical aspect of water security is the design of sensor networks to rapidly detect contaminants. This presentation will discuss OR challenges for modeling and solving complex sensor placement formulations. In particular, we will consider how nonlinearities can be managed to provide scalable techniques for large-scale sensor placement applications.

3 - Braess-like Paradoxes on a Bipartite Exchange Network: More Connections Are Not Always Better

Randall Laviolette, Sandia National Laboratories, MS 1235, P.O. Box 5800, Albuquerque, NM, 87185, United States of America, ralavio@sandia.gov, Vitus Leung

We model exchanges in which price is fixed and the amount transferred depends only on supply, demand, and links between actors. We prove that trading sessions on the resulting bipartite graph can reduce demand to zero iff it consists of components each of which are complete bipartite and for each, supply equals or exceeds demand. A Braess-like paradox can be generated for a minimally connected bipartite graph whose demand can be reduced to zero, because it may fail to do so as links are added.

■ SA14

C-Room 27A, Upper Level

Innovative Applications of CP

Sponsor: Computing Society
Sponsored Session

Chair: Laurent Michel, Associate Professor, University of Connecticut, 371 Fairfield Rd, Storrs, CT, 06269, United States of America, ldm@engr.uconn.edu

1 - Real-Time Tabu Search for Video Tracking Association

Ivan Dotu, Postdoctoral Researcher, Brown University, 115 Waterman st., Providence, RI, United States of America, idotu@cs.brown.edu

This work considers the data association problem arising in Intelligent Visual Surveillance (IVS) systems, which consists in assigning blobs (connected sets of pixels) to tracks (objects being monitored) in order to minimize the distance of the resulting scene to its prediction (which may be obtained with a Kalman Filter). We propose a tabu-search algorithm for this multi-assignment problem that can process more than 11 frames per seconds, thus, significantly outperforming the state of the art.

2 - Constraint Programming Applications From IBM Research

Yehuda Naveh, Haifa Research Lab, IBM, Haifa University Campus, Mount Carmel, Haifa, 31905, Israel, NAVEH@il.ibm.com, Yael Ben-Haim, Bella Dubrov, Odellia Boni, Sigal Asaf, Merav Aharoni, Wesam Ibraheem, Michael Veksler, Haggai Eran, Ari Freund

IBM Research has long been in the business of developing constraint solvers and using them for hardware verification and for steel manufacturing scheduling. In this talk we will present newer industrial applications of our solvers, namely, workforce management, vehicle configuration, floorplanning, and virtual machine placement. We will focus on the challenges of each domain, and the CP-based solutions we designed for solving them. We will describe the extent of usage of the applications by IBM.

■ SA15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Oracle - Crystal Ball

Michael Franden, Oracle, 77 Technology Way, Denver, CO, michael.franden@oracle.com

Oracle's Crystal Ball software is a spreadsheet-based software suite for predictive modeling, forecasting, Monte Carlo simulation and optimization. Our software is used in over 800 universities and schools worldwide for teaching risk analysis concepts. Teaching applications for Crystal Ball include financial risk analysis, valuation, engineering, portfolio allocation, cost estimation and project management.

2 - American Optimal Decisions - Portfolio Safeguard by AORDA
Gaia Serraino, Consultant, American Optical Decisions, 5214 SW. 91 Way, Suite #130, Gainesville, FL, 32608, United States of America, serraino@aorda.com

Portfolio Safeguard by AORDA is an advanced optimization package for risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (linear, quadratic, maximum, St. Dev., variance, probability, VaR, CVaR, cardinality, fixed-charge). Real-life case studies in Windows, MATLAB, C++, Run-File. Download problems/data from www.aorda.com/aod/psg.action.

■ SA16

C-Room 28A, Upper Level

Social Networks and Web 2.0

Sponsor: Information Systems
Sponsored Session

Chair: Param Singh, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, United States of America, psidhu@cmu.edu

1 - The Existence and Identification of Influentials
Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

There is debate as to whether influentials, a minority who influence an exceptional number of their peers, are important to the formation of public opinion. We explore the so-called influentials hypothesis. We find that the existence, identity, and relative influence of influentials is inextricably tied to the structure of spillovers. We show that identifying influentials can be a hard problem and that even in simple domains effective heuristics are functions of the full influence network.

2 - Informational Cascades and Contagion in Online Social Networks
Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu, Jeong-ha Oh, Yong Tan

Cascades are triggered when small initial shocks affect highly connected nodes in a social network. In this paper we are interested in how the network structures on YouTube influence the formation and propagation of informational cascades that lead to the phenomenal popularity of some videos. The two questions we explore are: (i) what characteristics of content creators and content adopters cause online informational cascades? and (ii) how does network position of users cause cascades to tip?

3 - Privacy Concerns and Information Disclosure: An Illusion of Control Hypothesis
Laura Brandimarte, PhD Student, Carnegie Mellon University - Heinz College, 4800 Forbes Avenue - Room 238, Pittsburgh, PA, 15213, United States of America, laura.brandimarte@email.it, Alessandro Acquisti

This paper investigates one possible explanation for people's conflicting attitudes regarding revelation and protection of private information. We introduce and test the hypothesis that people may confuse control over publication with control over accessibility to private information by third parties: an hypothesis we refer to as 'illusion of control'. Results from 2 experiments (surveys to students of a North American University) provide empirical evidence of illusion of control.

4 - Do I Follow My Friends or the Crowd? Informational Cascades in Online Movie Rating
Young Jin Lee, University of Washington, Foster School of Business, Box 353200, Seattle, WA, 98195, United States of America, younglee@u.washington.edu, Yong Tan

Online product review as a form of online Word of Mouth (WOM) and User-Generated Content has attracted much attention recently. This study analyzes how online movie user ratings are generated through a complex interrelationship between product information, marketing effort, and social influences. In particular, we examine the effect of comparable WOM from the crowd and friends on user movie ratings.

■ SA17

C-Room 28B, Upper Level

Digital Technologies and Public Policy

Sponsor: Information Systems
Sponsored Session

Chair: Xianjun Geng, Assistant Professor, University of Washington, Michael G. Foster School of Business, University of Washington, Box 353200, Seattle, WA, 98195, United States of America, gengxj@u.washington.edu

1 - Entertainment Without Borders: The Impact of Digital Technology on Government Cultural Policies
Jane Feng, Assistant Professor, University of Florida, 360 Stuzin Hall, Gainesville, FL, 32611, United States of America, jane.feng@cba.ufl.edu, Hsing Cheng, Sean Marston

New distribution avenues created by digital technology have allowed domestic consumers to access foreign entertainment programs while bypassing the government protection methods. Using a unified analytical framework we study the impact of the government's choice of cultural protection policies including quota, tariff, and subsidy, on domestic firm profits and consumers.

2 - Competing with Piracy: A Multi-Channel Sequential Search Approach
Xianjun Geng, Assistant Professor, University of Washington, Michael G. Foster School of Business, University of Washington, Box 353200, Seattle, WA, 98195, United States of America, gengxj@u.washington.edu, Young Jin Lee

We consider an online market where consumers may obtain digital goods from two alternative channels: the legitimate channel consisting of some law-biding retailers, or the piracy channel consisting of some piracy services. We analyze consumer choice, retailer strategy and piracy control using a sequential search approach where it is costly for some consumers (non-shoppers), yet costless for others (shoppers), to search for information.

3 - New Generation Games - Online or Offline?
Fang Fang, Assistant Professor, California State Univ. at San Marcos, 333 S Twin Oaks Valley Rd, San Marcos, CA, 92096, United States of America, fangfang@csusm.edu, Yi Sun, Jack Leu

Many video games now have both online and offline versions, while some have online (or offline) versions only. We analyze strategies for releasing video games based on two factors affecting a player's version selection: gaming skill and social enjoyment level. More specifically, we attempt to answer the following research questions from the perspective of a game provider: whether providing the offline version of a game helps improves the profit or hurts the profit by introducing competition.

4 - Effects of Online Marketing Communication Exposures on Final Conversion
Lizhen Xu, University of Texas at Austin, 1 University Station B6500, IROM Department, Austin, TX, 78712, United States of America, Lizhen.Xu@phd.mccombs.utexas.edu, Jianqing Chen, Andrew Whinston

Advertisers spend millions of dollars on various online marketing communication (MarCom) vehicles. How are they worth it? This paper investigates the effects of different online MarCom vehicles on the conversion of consumers, based on a dataset from a major electronic device manufacturer and seller recording all of its MarCom interactions with consumers and the associated purchases. We use a panel probit model to estimate the marginal effect of each MarCom click on the likelihood of purchase.

■ SA18

C-Room 28C, Upper Level

Stochastic Control and Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Yang Wang, Stanford University, Packard Electrical Engineering, 350 Serra Mall, Stanford, CA, 94305, United States of America, yw224@stanford.edu

1 - Singular Stochastic Control and Composite Markov Processes
Xiren Cao, Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, eecao@ust.edu.hk

We propose a composite model for Markov processes. The state space of a composite Markov process consists of two parts, J and J-. When the process is in J-, it evolves like a continuous-time Levy process; and once the process enters J, it makes a jump instantly like a discrete-time Markov chain. The composite Markov process provides a new model for singular stochastic control problem, and we show that this problem can be solved using a direct-comparison method.

2 - Computationally Tractable Performance Bounds for Constrained Linear Stochastic Control
Yang Wang, Stanford University, Packard Electrical Engineering, 350 Serra Mall, Stanford, CA, 94305, United States of America, yw224@stanford.edu

We present computational lower bounds on performance for constrained linear stochastic control. Our method involves solving a semidefinite program, a convex optimization problem which we can solve efficiently. Numerical experiments show that the lower bound obtained by our method is often close to the performance achieved by suboptimal control policies. As a by-product, our bound yields approximate value functions that can be used as control Lyapunov functions for suboptimal control methods.

3 - Structural Properties of the Value of Information in Single-Stage Ranking and Selection

Peter Frazier, Assistant Professor, Cornell University, Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

Within the Bayesian ranking and selection problem with independent normal priors and independent normal sampling noise, we consider the expected value of information obtained from a non-sequential sampling allocation. This quantity is known to be a non-concave function of the sampling allocation, which makes finding the optimal allocation difficult. Nevertheless, this function possesses a number of structural properties. We discuss these properties and their application.

4 - Optimal Learning On a Graph

Ilya Ryzhov, Princeton University, Princeton, NJ, 08540, United States of America, iryzhov@princeton.edu, Warren Powell

Consider a stochastic path-finding problem on a graph where the distributions of the arc costs are unknown. By sequentially measuring individual edges, we can refine Bayesian estimates of the arc costs. Our goal is to allocate measurements in order to efficiently learn about the optimal solution to the path-finding problem. We propose a knowledge gradient policy that is easy to compute, with certain desirable theoretical properties, and performs competitively against other learning strategies.

■ SA19

C-Room 28D, Upper Level

Advances in Network Flow Models I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Avinash Unnikrishnan, University Texas Austin, Austin, United States of America, avinash@mail.utexas.edu

1 - A Diversity Maximization Algorithm for the Shortest Path Problem with SSD Constraints

Marco Nie, Assistant Professor, Northwestern University, Evanston, United States of America, y-nie@northwestern.edu

This paper studies optimal path problems integrated with second order stochastic dominance (SSD) constraints. An equivalent linear program of the problem can be constructed by transforming the SSD constraint into a finite number of linear constraints. To solve the problem efficiently, an approximation algorithm based on the idea of diversity maximization is proposed. The algorithm is found to be an competitive alternative for large instances of the problem.

2 - Time-dependent Shortest Path Reformulation and Algorithm for Solving Off-line Map Matching Problem

Tao Xing, Graduate Research Assistant, The University of Utah, Civil and Materials Engineering, 122 Central Campus Drive, Rm. 104, Salt Lake City, UT, tao.xing@utah.edu, Xuesong Zhou

Map matching is a core task in converting raw GPS location data to useful traffic information. This research reformulates and solves the off-line map matching problem by a time-dependent shortest path algorithm that can simultaneously estimate the most likely activity tour on a transportation network and the resulting travel time on matched links.

3 - The Capacitated Vehicle Routing Problem with Backhauls on Tree-like Networks

Roshan Kumar, University of Texas at Austin, Ernest Cockrell, Jr. Hall, 6.202, 1 University Station C1761, Austin, TX, 78712, United States of America, roshan@mail.utexas.edu, Avinash Unnikrishnan, Travis Waller

The focus of this work is to solve the vehicle routing problem with backhauls when the underlying network has a tree-like structure. Such networks usually arise in situations where the cost of construction and maintenance of access infrastructure far exceeds the routing costs. A mathematical programming formulation will be provided along with some heuristics. The computational performance of this problem structure will be compared with that of the traditional VRP with backhauls.

■ SA20

C-Room 28E, Upper Level

Heuristics for Vehicle Routing Problems I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Miguel Andres Figliozzi, Assistant Professor, Portland State University, P.O. Box 751, Portland, OR, 97207-0751, United States of America, figliozzi@pdx.edu

1 - The Generalized Location Routing Problem with Profits

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Yue Geng, Olivier de Weck, Jaemyung Ahn

In exploring the surface of a planetary body, a unique routing problem is encountered. It considers profits at sites and resource consumption along routes depends on the selected strategy. We solve the underlying model by branch-and-price. In addition, a novel problem specific heuristic is developed.

2 - Delivering Bagged Cement From a Central Depot in Brazil

Claudio Cunha, Universidade de São Paulo, São Paulo, Brazil, cbcunha@usp.br, Marcos Miura

The problem consists in defining how to assign deliveries to a heterogeneous fleet of vehicles aiming to minimize freight costs which takes into account distance-based cost only when a route comprises deliveries located in different municipalities. Our heuristic is based on solving a bin-packing problem for those vehicles which serve clients located within the same municipality and a VRP problem for those vehicles servicing customers located in different municipalities.

3 - Restricted Dynamic Programming: A Flexible Framework for Solving Realistic Vehicle Routing Problems

Leendert Kok, University of Twente, P.O. Box 217, Enschede, Netherlands, a.l.kok@utwente.nl, Erwin Hans, Marco Schutten

Local search has been very successful in solving large vehicle routing problems (VRPs). However, these approaches are tailor-made for specific VRP types. Next, they are inflexible to deal with common timing restrictions such as time-dependent travel times and driving hours regulations. We propose a restricted dynamic programming (DP) algorithm, which forms a general framework for solving various VRP types. We show that DP is well-suited for including complex timing restrictions within the VRP.

4 - An Algorithm for the Vehicle Routing Problem with Stochastic Travel Times and Customer Deadlines

Miguel Andres Figliozzi, Assistant Professor, Portland State University, P.O. Box 751, Portland, OR, 97207-0751, United States of America, figliozzi@pdx.edu

A new approach based on an iterative and recursive algorithm is used to solve the vehicle routing problem with stochastic travel times and customer deadlines. In this problem customers must be serviced before a known deadline to avoid late or no-show penalties. A modeling approach to evaluate the objective function and represent discrete or continuous travel time distributions is discussed. Solution quality and computational time using real-world travel time data are presented and discussed.

■ SA21

C-Room 30B, Upper Level

Joint Session AAS/TSL: Airport Operations I

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Yoon Jung, Aerospace Engineer, NASA, NASA Ames Research Center, Mail Stop 210-6, Moffett Field, CA, 94035, United States of America, yoon.c.jung@nasa.gov

1 - Airport Configuration Planning under Weather Uncertainties

Leihong Li, Georgia Institute of Technology, leihong.li@gatech.edu, John-Paul Clarke

The set of feasible airport configurations is constrained by rules regarding allowable crosswind and tailwind. Thus, because weather is stochastic and configuration changes result in lost capacity, airports are often stuck in the "wrong" configuration. We present an innovative decision-making approach for airport configuration planning in which the likelihood and cost of being forced to make a configuration change is explicitly considered in the airport configuration decision.

2 - Optimization Techniques and Practical Experiments in Balancing Environmental and Operational Factors

Terence Thompson, Metron Aviation, Dulles, VA, United States of America, terry@metronaviation.com

We discuss recently developed techniques for including environmental effects (noise, air quality, and climate) in planning algorithms for use in control of aircraft movements on the airport surface. We report on experiments applying these techniques to actual operations as recorded in surveillance data, as well as feasibility demonstrations in a simulation environment. We also discuss extensions of these techniques to include airborne activities.

3 - Base Location and Fleet Allocation for Per-seat, On-demand Air Transportation

Gizem Keysan, Senior Analyst, United Airlines, 1200 E Algonquin Road, Elk Grove Township, IL, 60007, United States of America, gizem.keysan@united.com, George Nemhauser, Martin Savelsbergh

We discuss two approaches that capture the information about flight scheduling with different levels of detail while determining the base location and fleet allocation decisions for per-seat, on-demand air transportation. Firstly, we use such information in a traditional facility location problem. The second approach is based on a model that works directly with transportation requests and integrates a simplified version of flight scheduling with the base location and fleet allocation decisions.

4 - Departure Aircraft Metering for Efficient Airport Surface Operations

Waqar Malik, Associate Research Scientist, University Affliliated Research Center, Building 210, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States of America, waqar.malik@nasa.gov, Gautam Gupta, Yoon Jung

We develop a model for the automatic metering of departure aircraft at spot/gate. The model runs over two time frames: long term (half hour or more in future) for collaborative decision making, and short term (immediate) for decision regarding the release of aircraft. The purpose is to provide the controller a schedule of spot/gate release times optimized for runway utilization. The model is tested in nominal and heavy surface traffic scenarios, and computational results are provided.

■ SA22

C-Room 30C, Upper Level

Public Transit I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg., Room 301I, College Station, TX, 77843-3136, United States of America, lquadrifoglio@civil.tamu.edu

1 - Towards the Solution of the Route Design Problem on Bus Rapid Transit Systems

Andrès L. Medaglia, Departamento de Ingenierìa Industrial, Universidad de los Andes, Carrera 1 Este # 19 A- 40, Bogotà, Colombia, amedagli@uniandes.edu.co, Maryory Gomez, Jose L. Walteros

A Bus Rapid Transit (BRT) system is a high-capacity low-cost public transit solution. The BRT Route Design Problem finds a set of routes that minimizes passengers travel time while simultaneously satisfying technical constraints. We propose a decomposition strategy that decouples the route selection decisions (genetic algorithm) from the BRT performance evaluation (network model). To solve a real problem it was necessary to adjust the trip distribution (OD-matrix) using optimization.

2 - Dynamic Transit and Traffic Assignment

Mark Hickman, University of Arizona, Tucson, AZ, mhickman@email.arizona.edu, Yi-Chang Chiu

We consider a dynamic transportation assignment system, including both transit and traffic assignment. Most existing dynamic traffic assignment (DTA) models do not explicitly include transit, which limits their applicability. We describe a dynamic transit assignment model which can work directly within a DTA model, provided that one looks at person assignment in addition to vehicle assignment. The assignment model is described and illustrated with a small a case study.

3 - System-wide Signal Timing Optimization with Transit Priority for Conflicting Bus Routes

Eleni Christofa, PhD Student, Institute of Transportation Studies, U.C. Berkeley, 109 McLaughlin Hall, Berkeley, CA, 94720-1720, United States of America, eleni_christofa@berkeley.edu, Alexander Skabardonis

Existing transit signal priority (TSP) strategies have not addressed the problem of granting priority on transit vehicles traveling in conflicting directions. We developed and tested an adaptive TSP algorithm for a single intersection that incorporates occupancy, schedule adherence and other transit measures. Currently, we are extending the algorithm on networks, accounting for signal coordination and system-related performance measures for autos and transit.

4 - Optimal Cycle Time for a Feeder Transit Service in El Cenizo, TX

Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg., Room 301I, College Station, TX, 77843-3136, United States of America, lquadrifoglio@civil.tamu.edu

Colonias along the US-Mexico border are one of the most rapidly growing areas in Texas with inadequate transportation services. The objective of this paper is to determine the optimal cycle time of a potential feeder transit serivice operating in a representative Colonia (El Cenizo, TX) using demand data collected through a travel survey. Results showed that the cycle time between consecutive departures from the terminal should be around 11-13 minutes for best service quality.

■ SA23

C-Room 30D, Upper Level

Impacting Military Policy through Operations Research

Sponsor: Military Applications Society
Sponsored Session

Chair: Elvira Loredo, Researcher, Full, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90404, United States of America, loredo@rand.org

1 - Incorporating Robustness Modeling Into Materiel Management Analyses

Ronald McGarvey, Senior Operations Researcher, RAND Corporation, HQ AMC/A9, 402 Scott Drive, Unit 3M12, Scott AFB, IL, 62225, United States of America, ronm@rand.org

Within this presentation, we quantify some of the costs and benefits associated with establishing centralized management and control for Air Force War Reserve Materiel. We demonstrate how a global manager can establish a robust posture (guarantees support of asset delivery timelines, even in the event of unplanned loss of access to a logistics site) at relatively low additional cost beyond the pure "min-cost solutiondescribing the modeling challenges associated with capturing such robustness.

2 - Assessing Stop-loss Policy Options through Personnel Flow Modeling

Stephan Brady, Assistant Professor of Operations and Supply Chain Management, Penn State Harrisburg, E-355 Olmsted Building, 777 West Harrisburg Pike, Middletown, PA, 17057, United States of America, stephan.brady@psu.edu

The practice of stop-loss retains soldiers who are scheduled to end their voluntary terms of service during an impending or ongoing deployment. It has seen decades of use...and contentious debate. Personnel policy alternatives to stop-loss were examined with a large-scale discrete-event simulator, tracking individual daily global assignment decisions and the resultant effects on unit strengths and cohesion. With data and advice provided by Army staff, the study helped in a recent decision by the Secretary of Defense and President to end stop-loss for current U.S. engagements.

3 - US Army Logistics Innovation Agency Cost to Readiness Model

John Dulin, Concurrent Technologies Corp., 100 CTC Drive, Johnstown, PA, 15904, United States of America, dulinj@ctc.com, Thomas Turner

CTC has created a Decision Support System for the Army Logistics Innovation Agency (LIA) that provides historical, current and forecasted information relating the costs and readiness of the Army's 16 SORT Systems. It is an interactive tool that provides leaders with data previously found only in disparate sources, and identifies relationships between elements that had previously been unexplored. In the tool are variety of analytic techniques including forecasting, regression, and correlations.

■ SA24

C-Room 30E, Upper Level

OR/MS for Enterprise Transformation I

Sponsor: Military Applications Society
Sponsored Session

Chair: Greg Parlier, SAIC, 255 Avian Lane, Madison, AL, 35758, United States of America, greg.h.parlier@saic.com

1 - UH-60L Operational Availability

John Scales, SAIC, 6725 Odyssey Drive, Huntsville, AL, 35806, United States of America, john.r.scales@saic.com, Jennifer Suckow

Currently the US Army is analyzing the effects of various components of its supply chain on equipment readiness. The initial analysis has concentrated on

the UH-60L Blackhawk helicopter. In order to explore the effects of changes to various policies being considered it must first be understood what processes drive the operational availability of the aircraft on the flight line. The output from extensive data analysis has been distilled into a spreadsheet model.

2 - OR Analysis Role in Shaping Navy ERP Single Supply Solution Implementation

Walt Degrange, US Navy, 5450 Carlisle Pike, P.O. Box 2020, Mechanicsburg, PA, 17055-0788, United States of America, walt.degrange@navy.mil

Navy ERP Single Supply Solution is a major process and system implementation that promises new capabilities for Supply Chain Management, improved forecasting, and better asset visibility. The Naval Inventory Control Point Operations Research Department is tasked with conducting comparative and predictive analysis for ERP. This brief covers the lessons learned over the past few years of development and the analytical challenges of implementing a Commercial Off the Shelf software.

3 - A Center for Innovation in Logistics Systems (CILS)

Greg Parlier, SAIC, 255 Avian Lane, Madison, AL, 35758, United States of America, greg.h.parlier@saic.com

Fully enagaged in the Global War on Terror, the US Army is also committed to a comprehensive and ambitious "Transformation" endeavor. An analytical architecture is presented which consists of several "catalysts for innovation" and four complementary modeling approaches collectively referred to as Dynamic Strategic Logistics Planning. An organizational construct is presented to sustain continual improvement for Army supply chain management - a "Center for Innovation in Logistics Systems".

■ SA25

C-Room 31A, Upper Level

Aviation Applications Section Dissertation Award Finalists

Sponsor: Aviation Applications
Sponsored Session

Chair: Mustafa Akan, Assistant Professor of Operations Management, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue Posner Hall 381C, Pittsburgh, PA, 15213, United States of America, akan@cmu.edu

1 - Aviation Applications Section Dissertation Award Finalists

Mustafa Akan, Professor, Carnegie Mellon, akan@andrew.cmu.edu

The dissertation prize is given annually by The Aviation Applications Section of INFORMS for the best dissertation in any area related to aviation OR (air traffic management OR and airline OR).

2 - Finalist - Tactical and Operational Planning for Per-Seat, On-Demand Air Transportation

Gizem Keysan, 1701 Wildflower Ct., Schaumburg, IL, 60173, gkeysan@isye.gatech.edu, United Airlines

This thesis addresses two planning problems motivated by the operations of per-seat, on-demand air transportation. The first problem focuses on the scheduled maintenance of the fleet that has to be done periodically for safety. The second problem is concerned with selecting locations for bases and determining how many jets to allocate to each base where bases are airports with hangar space to keep jets overnight. Both problems have significant impacts on the profitability of the business.

3 - Finalist - Mitigating Airport Congestion: Market Mechanisms and Airline Response Models

Pavithra Harsha, MIT, 77 Massachusetts Avenue, Room No. 32-D714, Cambridge, MA, 02139, pavithraharsha@gmail.com

We study two demand-management techniques to mitigate airport congestion, strategic and operational techniques. As a strategic initiative, we study slot auctions and focus on two aspects of its design: (1) a strategic decision support tool to help airlines value runway slots; and, (2) activity rules that suppresses strategic behavior and promotes simple, meaningful bidding for airlines in a slot auction. We discuss our models and computational results on data from a real-carrier. We also briefly discuss ways to evaluate different real-time allocation schemes.

■ SA26

C-Room 31B, Upper Level

Certification Process for OR/MS Professionals

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Michael McCoy, The Boeing Company, michael.s.mccoy@boeing.com

1 - INFORMS: "Body of Knowledge"

Jennifer Leong, Senior Consultant, Booz | Allen | Hamilton, Modeling Simulation Wargaming Analysis (

When developing a credential, a "Body of Knowledge" (BOK) is a set of accepted and agreed upon standards in field or profession. In this session, INFORMS Credentialing Committee investigates the demand and the necessary resources to establish and maintain an INFORMS Operations Research & Management Science (ORMS) Body of Knowledge.

2 - Taking into Account Education in Credentialing

René Séguin, Operational Research and Analysis Directorate (ORAD), Defence Research and Development Canada, Centre for Operational Research and Anal, Canada

In examining the credentialing process for OR practitioners one aspect that needs to be addressed is how to take into account the education background of the applicant. Is a degree in OR/MS mandatory or is it just a nice-to-have component? Are all types of degrees equivalent? How much does a Ph. D. buys you? Should education and work experience be combined with some kind of formula? What constitute a valid OR/MS degree? This talk will try to give answers to all these questions.

3 - Single versus Multi-level Certification

Robert L. Simons, Technical Fellow, The Boeing Company

This initiative involves documenting a high-level trade study activity investigating a single versus multi-level certification methodology for the INFORMS Practitioner Community in general, and the Practioner-focused Operations Research certificate in particular. The approach involves identifying supporting rationale, capturing evaluation criteria, establishing acceptance thresholds, and formulating appropriate criteria scoring. Inputs will be sought to strengthen this initial activity and follow-on detailed decision analysis activities.

■ SA27

C-Room 31C, Upper Level

Simulation Approaches for Selecting the Best System

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Sigrun Andradottir, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, sa@gatech.edu

1 - Sequential Procedures for Comparing Systems with Multiple Constraints

Christopher Healey, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, cmheal@gatech.edu, Seong-Hee Kim, Sigrun Andradottir

Consider the problem of selecting the best feasible system with constraints on multiple simulated performance measures. We develop fully-sequential procedures that guarantee a nominal probability of correct selection, taking both feasibility and optimality into account. We also provide a recommended error allocation as a function of the number of constraints for efficient implementation.

2 - Challenges of Optimisation under Risk

Felisa Vazquez-Abad, Professor, Hunter College CUNY, New York, New York, United States of America, felisav@unimelb.edu.au

We study problems of optimization under risk, where the risk is of a qualitative and not quantitative nature. The problem is posed as that of minimizing costs subject to probability constraints. We discuss difficulties of simulation optimization methods and possible solutions. We include examples in various fields, such as finance and the energy sectors.

3 - Is Mean-based Selection Good Enough in Ranking and Selection Procedures?
Demet Batur, Post Doctoral Research Associate, IMSE, University of Nebraska-Lincoln, 175 Nebraska Hall, Lincoln, NE, 68588, United States of America, dbatur2@unl.edu, Fred Choobineh

The legacy simulation approach for the ranking and selection procedures is to compare systems based on a mean performance metric. The best system is most often deemed as the one with the largest (or smallest) mean performance metric. We discuss limitations of the mean-based selection approach and explore the advantages of other decision theoretic approaches that utilize at least part of the distribution function of the performance metric.

4 - Hybrid Probabilistic Search Methods for Simulation Optimization
Alireza Kabirian, Assistant Professor, University of Alaska-Anchorage, College of Business and Public Policy, 3211 Providence Drive, Anchorage, AK, 99508-4614, United States of America, a_kabirian@yahoo.com, Sigurdur Olafsson

Randomness in simulation outputs often challenges the correct selection of the optimum in simulation based optimization. We propose an algorithm that merges Indifference Zone methods with a large subclass of Random Search methods for continuous optimization via simulation. Under a mild assumption, we prove asymptotic convergence of the algorithm to a global optimum. The new algorithm addresses the noise in simulation outputs while benefits the proven efficiency of Random Search methods.

5 - Selecting the Best System: Do Common Random Numbers Help?
Christopher Healey, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, cmheal@gatech.edu, Seong-Hee Kim, Sigrun Andradottir

Inducing positive correlation across systems, usually through the use of common random numbers, is a tool for improving the efficiency of the comparison of stochastic systems. We show how high positive correlation can adversely affect the probability of correct selection, even with normally distributed data, for certain fully-sequential selection procedures. We also suggest an adjustment to achieve the desired probability of correct selection.

■ SA28

H-Room 500, Fifth Floor

Joint Session MIF/ QSR: Applied Environmental, Economic and Social Science Methods

Sponsor: Minority Issues Forum & Quality, Statistics and Reliability Sponsored Session

Chair: Kobi Abayomi, Asst. Professor - Statistics, Georgia Tech, H. Milton Stewart School of Industrial a, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, kobi@gatech.edu

1 - Indexing Methodology for Millennium Development Goals
Gonzalo Pizarro, Policy Specialist for the MDGs, United Nations Development Programme, 304 East 45th Street, Office 1052, New York, NY, 10017, United States of America, gonzalo.pizarro@undp.org, Yizi Chen, renata rubian, Kobi Abayomi

We develop an index - a linear combination of multivariate data - to assist in evaluation of country by country progress in maternal health: one of the United Nations Millennium Development Goals.

2 - Calibration of Thiel's Index
Kobi Abayomi, Asst. Prof - Statistics, Georgia Tech, H. Milton Stewart School of Industrial a, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, kobi@gatech.edu, William Darity Jr.

Thiel's index, an information theoretic measure of dispersion familiar to economists, can be partitioned as within and across group divergences. This partitioning, however, is skew-sensitive in that within group divergence may outweigh across group divergence. We investigate a calibration of Thiel's index that accounts for this sensitivity.

3 - Price Dispersion in Person-to-Person Lending (P2PL) Markets
Samuel Garman, Carnegie Mellon University, H. John Heinz III College, Pittsburgh, United States of America, sgarman@andrew.cmu.edu, Robert Hampshire

We examine the nascent but growing Person-to-Person Lending (P2PL) markets from a search theoretic perspective. Empirical observations from P2PL data show substantial dispersion in interest rates for similar borrowers, suggesting these markets are far from frictionless. We model and quantify the frictions to better understand market behavior and P2PL's potential. The insights may be useful in analyzing technology, policy, and mechanism changes that can improve the functioning of P2PL markets.

■ SA29

H-Room 501, Fifth Floor

Real Options in the Energy Sector

Sponsor: Energy, Natural Res & the Environment/Energy Sponsored Session

Chair: Afzal Siddiqui, University College London, Gower Street, London, WC1E 6BT, United Kingdom, afzal@stats.ucl.ac.uk

1 - Using Fuzzy Real Options Valuation for Assessing Investments in CO2-free Power Generation
Reinhard Madlener, Professor, RWTH Aachen Univ, E.ON ERC/FCN, Templergraben 55, Aachen, 52056, Germany, RMadlener@eonerc.rwth-aachen.de, Christian Kraemer

We study the relative advantage of investing in an integrated combined-cycle (IGCC) power plant vs. a conventional coal-fired power plant with and without carbon capture and storage (CCS). For the analysis we apply fuzzy real options theory and consider three price scenarios for fuel input and CO2 emissions. We find some evidence that the IGCC and (to a lesser degree) the conventional hard coal-fired power plant are most economical, followed by the two CCS options 'Oxyfuel' and 'Pre-combustion'.

2 - Irreversible Investment, Depreciation, and Tax Law Uncertainty
Ryuta Takashima, Assistant Professor, Chiba Institute of Technology, 2-17-1 Tsudanuma, Narashino-shi, Chiba, 275-0016, Japan, takashima@sun.it-chiba.ac.jp

We study the investment of the firm under uncertainties of both cash flows and tax law. The uncertainty of tax law which is considered in this paper is the switching between the different depreciation methods. We analyze the effect of new depreciation method, which has been introduced in Japan's nuclear policy, on the investment decision of nuclear power plants. It is shown that how regal durable years and construction times of nuclear power plants affect the investment threshold.

3 - Are Real Options Exercised Rationally? Evidence From Small Hydropower Plants
Stein-Erik Fleten, Professor, NTNU Norway, Department Industrial Econ and Technology Mgmt., Trondheim, NO-7491, Norway, stein-erik.fleten@iot.ntnu.no, Hans Petter Wenngren, Johan Sollie, Jussi Keppo

In Norway there are many good sites for small hydropower, and many of these have been developed during the last few years. Having access to such a site is viewed as holding a real option to invest. Using data from 225 such projects we study the investment behavior of the developers. Profitability depends on expectations regarding long-term prices, and information on this is available at Nord Pool's electricity forward market.

4 - Optimal Investment and Operational Decision-Making under Risk Aversion and Uncertainty
Afzal Siddiqui, University College London, Gower Street, London, WC1E 6BT, United Kingdom, afzal@stats.ucl.ac.uk, Michail Chronopoulos, Bert De Reyck

Real options addresses investment under uncertainty assuming a risk-neutral decision-maker. Investment and operational thresholds may be obtained by solving nested optimal stopping time problems. However, for decision-makers with undiversifiable risks, e.g., in the renewable energy R&D sector or in nascent energy markets, risk aversion needs to be taken into account. We find that risk aversion lowers the probability of investment, which may be mitigated by operational flexibility.

■ SA30

H-Room 502, Fifth Floor

Green Energy I

Sponsor: Energy, Natural Res & the Environment/Energy Sponsored Session

Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

Co-Chair: Niko Iliadis, EnerCoRD, Plastira Street 4, Nea Smyrni, Athens, 171 21, Greece, niko.iliadis@enercord.com

Co-Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - Do More Batteries Make a Plug-in Hybrid Better?
CS Norman Shiau, PhD Candidate, Carnegie Mellon University, Mechanical Engineering, Scaif Hall, Pittsburgh, PA, 15213, United States of America, cshiau@cmu.edu, Constantine Samaras, Jeremy Michalek

Large battery packs in plug-in hybrid electric vehicles (PHEVs) allow greater distances to be traveled on electric power alone, but batteries are heavy and

expensive. We simulate PHEV systems to model the effects of additional batteries and to optimize vehicle design and allocation. We find that for drivers who can charge frequently, PHEVs with small battery packs have lower life cycle cost, petroleum consumption and greenhouse gas emissions than comparable alternatives.

2 - Modeling Energy Efficiency

Emily Bartholom Fisher, Johns Hopkins University, 3400 N. Charles St, Ames Hall 313, Baltimore, MD, 21218, United States of America, ebartho3@jhu.edu

End-use energy efficiency (a.k.a. the "fifth fuel") has been identified as a critical tool for meeting carbon reduction targets, but major challenges still exist for incorporating it into traditional energy modeling frameworks. In this talk I will review how energy efficiency is being modeled now, and outline how we might move forward to represent it better.

3 - Real Time Stability Monitoring and Control in the Smart Power Grid

M.A. Pai, Professor Emeritus, Univ of Illinois at Urbana-Champaign, Department of Electrical and Computer En, Urbana, IL, 61801, United States of America, mapai@illinois.edu

The addition of a wide spectrum of renewable resources with Wind Power as a major resource introduces a new set of complexities in the emerging smart grid. Wide Area Measurement Systems (WAMS) using GPS system will be the key component at the T and D level. In this paper we will focus on some aspects of this exciting new smart grid as related to real time stability monitoring and integration of wind power with the current grid.

4 - Demand Subsidies Versus R&D: Purely Organic Solar Cells

Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Gregory F. Nemet

We combine an expert elicitation and a bottom-up manufacturing cost model to compare the effects of R&D and demand subsidies. We model their effects on the future costs of a low-carbon energy technology that is not currently commercially available, purely organic photovoltaics. We find that R&D generally dominates subsidies, but that subsidies provide a hedge against failure in the R&D program.

5 - Enhanced Wind Farm Layout Optimization

Michele Samorani, Leeds School of Business - University of Colorado at Boulder, Bldg #4, UCB 419, Boulder, CO, 80309-0419, United States of America, michael.samorani@colorado.edu, Harald Reinertsen, Manuel Laguna

Optimally placing wind turbines in a given site is an important problem arising during the design of a wind farm. Existing approaches consider only few possible positions, which typically correspond to the vertices of a coarse square grid. We show that solution methods that can handle more positions and denser grids obtain higher quality solutions, corresponding to more efficient wind farms. A computational study on real sites shows the merit of our approach.

■ SA31

H-Room 503, Fifth Floor

Revenue Management and Pricing in Practice

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Tugrul Sanli, SAS Institute Inc., SAS Campus Dr, Cary, NC, 27513, United States of America, tugrul.sanli@sas.com

1 - Demand Modeling for Retail Price Optimization

Alex Chien, SAS Institute Inc., SAS Campus Dr., Cary, NC, 27513, United States of America, alex.chien@sas.com

The full benefit of price optimization simply cannot be capitalized on without an appropriate underlying demand model. This session will address the modeling and calibrating techniques of the following demand drivers commonly considered in retail price optimization: * Price elasticity and promotion effects * Cannibalization and halo effects * Psychological price effects * Seasonality * Product lifecycle effect * Competitors' price effect * Assortment and inventory effects.

2 - Automated Revenue Optimization for the Airport Parking Industry

Linda Hatfield, VP Product Management and Marketing, IDeaS - A SAS COMPANY, 8500 Normandale Lake Blvd, Suite 1200, Minneapolis, MN, 55437, United States of America, linda.hatfield@ideas.com

Automated pricing and revenue optimization is gaining a must-have status in many sectors, but both the organization and its customer base must be ready to embrace this new pricing approach for it to be effective. To capture the revenue potential and take advantage of the benefits of revenue optimization, the airport parking business needed a major change in its commercial approach. This session will describe the application of automated revenue optimization and the unique challenges faced.

■ SA32

H-Room 504, Fifth Level

Finance and Stochastics

Cluster: Financial Engineering
Invited Session

Chair: Erhan Bayraktar, Assistant Professor, University of Michigan, Department of Mathematics, 530 Church Street, Ann Arbor, MI, 48109, United States of America, erhan@umich.edu

1 - Optimal Stopping for Strict Local Martingales

Hao Xing, Post-doctoral Fellow, Boston University, United States of America, haoxing@umich.edu, Kostas Kardaras, Erhan Bayraktar

When the discounted price process is a strict local martingale, it is known that exercising the American call option at the terminal time is not optimal. In this talk, we will present a complete characterization of optimal stopping times for problems with strict local martingales. A necessary and sufficient condition for the existence of the optimal stopping times is also derived. We will discuss the implications of these results on the American call problem.

2 - Bond and Stock Market Equilibrium with Heterogeneous Agents Receiving Unspanned Income

Kasper Larsen, Assistant Professor, Carnegie Mellon, kasperl@andrew.cmu.edu

We provide the first closed-form solution for the equilibrium risk-free rate and the equilibrium stock price in a dynamic economy where agents have heterogeneous preferences and unspanned labor income risk. Due to the unspanned income risk investors will increase their demand for the risk-free asset, leading to a lower equilibrium risk-free rate than in a corresponding economy without unspanned income risk.

3 - Asymptotic Analysis of Utility-based Prices for Utilities Defined on the Whole Real Line

Mihai Sirbu, Assistant Professor, University of Texas at Austin, 1 University Ave C 1200, Austin, United States of America, sirbu@math.utexas.edu

We perform an asymptotic expansion of utility-based prices and hedging strategies for small number of contingent claims, in the framework of optimal investment with general utilities defined on the whole real line. Conceptually, this follows previous joint work with Dmitry Kramkov and relies on using the risk-tolerance wealth processes.

4 - Optimal Stopping for Nonlinear Expectations

Erhan Bayraktar, Assistant Professor, University of Michigan, Department of Mathematics, 530 Church Street, Ann Arbor, MI, 48109, United States of America, erhan@umich.edu, Song Yao

We develop a theory for solving continuous time optimal stopping problems for non-linear expectations. Our motivation is to consider problems in which the stopper uses risk measures to evaluate future rewards.

■ SA33

H-Room 505, Fifth Floor

Flexible Technology Management

Sponsor: Technology Management
Sponsored Session

Chair: Yingxia Yang, Massachusetts Institute of Technology, 550 Memorial Dr, Apt.11b3, Cambridge, MA, 02139, United States of America, yingxia@mit.edu

1 - Characterizing the Value of Technology Choice under Demand Uncertainty

Thomas Rand-Nash, PhD Student, MIT, 292 Main Street, e38-435, cambridge, ma, 02142, United States of America, trand@MIT.EDU, Richard Roth, Randolph Kirchain

Characterizing demand uncertainty over time may change the competitive position of new technologies. This work seeks to define how demand distribution characteristics impact the production volume at which multiple technologies reach revenue parity as a function of technological revenue structure. A case study is presented to model the value tradeoffs of two competing technologies used to produce the automotive body-in-white under demand uncertainty and over time.

2 - Multiple Sources of Manufacturing Flexibility and Their Interactions under Demand Uncertainty

Yingxia Yang, Massachusetts Institute of Technology, 550 Memorial Dr, Apt.11b3, Cambridge, MA, 02139, United States of America, yingxia@mit.edu, Randolph Kirchain, Richard Roth

This research studies multiple sources of flexibility to respond to demand uncertainty for manufacturing systems through a simple and hypothetical case. The impact of considering multiple sources of flexibility on strategic planning decisions is demonstrated and the trade-offs and interactions between multiple sources of flexibility are studied.

3 - ETK Model: Effects on Higher Education Faculty Satisfaction

Jorge Cardenas, Doctoral Student, Alliant International University, 5315 Triana St., San Diego, CA, 92117, United States of America, jcardenas@alliant.edu

This paper is a literature review and an analysis of a research study that implemented the ETK model. The ETK model and survey instrument recognizes and measures emotional human (E), technology (T), and knowledge (K) skills, abilities, and competencies that affect an organizations performance. The literature review condenses previous academic research and publications done on these skills, abilities, and competencies.

4 - Considering the Role of Labor Learning in the Value of Manufacturing Flexibility

Randolph Kirchain, Associate Professor, MIT, 77 Massachusetts Ave, E38-432, Cambridge, MA, 02139, United States of America, kirchain@mit.edu, Marie-Claude Nadeau, Richard Roth

Evaluation of manufacturing flexibility has largely assumed labor to be inherently flexible and irrelevant. However, learning effects lead to both costs and benefits associated with labor flexibility. Decision-tree models were applied to an automotive assembly case to illustrate the impact of labor learning on the value of flexibility. Results suggest that learning effects can notably increase this value. This effect grows with learning rate, demand volatility, and probability of demand growth.

■ SA34

H-Room 520, Fifth Floor

Closed-Loop Supply Chains

Cluster: Green Supply Chain
Invited Session

Chair: Michael Galbreth, University of South Carolina, Moore School of Business, Columbia, SC, 29208, United States of America, galbreth@moore.sc.edu

1 - Investing in Reusability and Collection: The Impact of Quality Condition Uncertainty

Tamer Boyaci, McGill University, 1001, Rue Sherbrooke Ouest, Montreal, QC, H3A 1G5, Canada, tamer.boyaci@mcgill.ca, Andreas Robotis, Vedat Verter

We study the effects of uncertainty in the quality condition of EOU products for an OEM who invests in (a) increasing the reusability level of a product and (b) in collecting EOU products. We consider a 2-period setting where in Period 1 the OEM makes investment decisions, and in Period 2 it collects, remanufactures and sells EOU products along with new ones. We show that the effect of quality condition uncertainty depends on the inspection capabilities, and is not always detrimental.

2 - Delayed Differentiation for Mutiple Lifecycle Products

Daniel Guide, Associate Professor, Penn State University, 464 Business Building, University Park, PA, 16802, United States of America, dguide@psu.edu, James Abbey, Gilvan Souza

Multiple lifecycle problems arise when a firm upgrades the performance of a base model over time via new modules. The end product is a blend of new and remanufactured components. The multiple lifecycle strategy requires an evolutionary approach to delayed differentiation design whereby the firm evolves their offerings from a single product configuration to n product configurations. This research model uses a delayed differentiation approach with a distinct push-pull boundary.

3 - Alternative Replenishment Policies under CO2-emission Restrictions

Kristel Hoen, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, K.M.R.Hoen@tue.nl, Tarkan Tan, Geert-Jan van Houtum, Jan Fransoo

In this talk we describe a method which can be used to determine the replenishment policy for items under CO2-emission restrictions. In this model we consider the transportation of items from a supplier to a production facility. Alternative modes of transportation are available for items and are used to reduce emissions. The method balances CO2-emissions and penalty, holding and transportation costs.

4 - Managing the Trade-off Between Remanufacturing and Product Innovation

Michael Galbreth, University of South Carolina, Moore School of Business, Columbia, SC, 29208, United States of America, galbreth@moore.sc.edu, Raul Chao

When a manufacturer introduces a new generation of a product, it is often able to acquire some fraction of the previous generations sales. This creates the opportunity for components from the acquired items to be reused in the new generation product. Component reuse across generations can lower production costs, but it also reduces innovativeness. We examine this tradeoff between component reuse and innovation in new product design across multiple product generations with used product returns.

■ SA35

H-Sapphire A, Fourth Floor

Capacity Management and Scheduling in Health Care Facilities

Sponsor: Health Applications
Sponsored Session

Chair: Xiuli Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, xqu@ncat.edu

1 - Multilevel Techniques for Quality Control Charts of Recovery Outcomes

Linda Laganga, Director of Quality Systems & Operational Excellence, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States of America, Linda.Laganga@mhcd.org, CJ McKinney, Antonio Olmos, Kate DeRoche

Early detection and response to change promotes effective resource utilization and capacity management. We use statistical quality control charts in the continued evaluation of mental healthcare services, and demonstrate that multilevel statistical techniques can improve the function of quality control charts in these settings. We apply multilevel techniques to the recovery outcome tools we developed and implemented to measure and communicate change in consumers of mental health services.

2 - Modeling the Arrival of Batch Appointments Within an Open-Access Scheduling System

Husniyah Abdus-Salaam, Graduate Student, North Carolina A&T State University, 400 McNair Hall, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, husniyah@gmail.com, Lauren Davis, Daniel Mota

Current research in open-access scheduling considers single provider models, where demand arrivals are independent among patients. We consider a multiple-provider model and study the impact of dependent demand arrivals on an open-access scheduling system. We develop a preliminary MDP model to determine when batch appointments should be accepted in a pediatric dental clinic, given there is an associated risk of no-shows for pre-scheduled appointments.

3 - Optimal and Approximate Algorithms for Sequential Clinical Scheduling with No-show

Ji Lin, Purdue University, Weldon School of Biomedical Engineering, West Lafayette, IN, 47907, United States of America, lin35@purdue.edu, Mark Lawley, Kumar Muthuraman

A significant problem in clinical operations is patient no-show. Random overbooking can compensate the revenue loss but results in longer patient waiting time and physician overtime. The myopic scheduling does not consider the future call-in pattern. To use this important information, we propose an MDP model. The optimal policy which selectively overbooks patients can be solved by Dynamic Programming Methods. Approximation algorithms are introduced to overcome the high computational complexity.

4 - Sustaining the Medical Home: A Game Theoretic Approach

Ping Huang, Research Scientist, Regenstrief Center for Healthcare Engineering, Purdue University, West Lafayette, IN, 47907, United States of America, huang74@purdue.edu, Mark Lawley, Fei Pan

One solution to rescue U.S.A.'s ailing health care system is to restructure primary care practices to incorporate principles of the patient-centered medical home (PCMH)delivery model. Such reengineering requires a payment approach that rewards good health outcome. However, none of the current payment methods will sustain PCMH. We show that our approach that includes FFS, capitation and incentive would sustain the PCMH structure, provided that PCMH can in fact improve care and reduce cost.

■ SA36

H-Sapphire B, Fourth Floor

Patient Management -Scheduling

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - Outpatient Appointment Scheduling
Song Chew, Assistant Professor, Southern Illinois University Edwardsville, Edwardsville, Edwardsville, IL, 62026, United States of America, schew@siue.edu

Outpatient appointment scheduling methodologies have been an active research area with plentiful significant results for the last few decades. It is however irrefutable that excessive costs incurred by patient waiting and staff workload are today still prevalent in clinics. Therefore, much more research is needed to bridge the gap between theory and practice. In this work, we seek to determine optimal interappointment times for outpatient schedules so that the total cost is minimized.

2 - Emergency Room Patient Scheduling
Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

Scheduling the emergency room patients is part of a comprehensive patient management system. Due to the nature of mixed patient arrivals at random, various urgency levels in medical needs of each patient, available service time at the facility, and cross-trained medical staff stationed in the emergency room, the emergency room scheduling is quite different with the appointment scheduling for other part of the healthcare. Analysis on model constructed will be carried out over a public database.

■ SA37

H-Sapphire C, Fourth Floor

Consumer-driven Operations Management

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Rachel Zhang, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, Hong Kong - ROC, rzhang@ust.hk

Co-Chair: Qian Liu, Assistant Professor, Hong Kong University of Science and Technology, HKUST, Hong Kong, Hong Kong - ROC, qianliu@ust.hk

1 - The Impact of Counterfeits on Brand Name Products
Jie Zhang, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, Hong Kong - ROC, jiezh@ust.hk, L. Jeff Hong, Rachel Zhang

This paper investigates the impact of counterfeits on the price, market share and profitability of brand name products and the strategies for them to fight counterfeiting. We first study how a non-deceptive counterfeit affects a brand name product in competitive markets and markets with two consumer segments each with different utilities. We then extend our analysis to different markets with a deceptive counterfeit and devise strategies for brand name companies to protect their products.

2 - Selling to Strategic Consumers with Consumption Externalities
Fuqiang Zhang, Assistant Professor, Washington University in St. Louis, FZhang22@WUSTL.EDU, Jiong Sun

It has been widely acknowledged that many products exhibit consumption externalities. That is, the utility a consumer derives from the consumption of a product may depend on the number of other users who consume the same product. This paper studies a firm's strategies when selling to strategic consumers with the presence of consumption externality effects.

3 - Selling to Heterogeneous Customers with Uncertain Valuations under Returns Policies
Qian Liu, Assistant Professor, Hong Kong University of Science and Technology, HKUST, Hong Kong, Hong Kong - ROC, qianliu@ust.hk, Wenqiang Xiao

We consider a firm that sells a product with a finite inventory to customers whose valuation consists of an intrinsic value which is privately known before purchase, and product fitness which is ex ante uncertain and revealed after purchase. We show that the established result - a menu of returns policies - may not be optimal with inventory constraints. We analyze how the results depend on customer heterogeneity, ex ante valuation uncertainty, inventory level and procurement cost.

■ SA38

H-Sapphire D, Fourth Floor

Advances in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Murat Kaya, Assistant Professor, Sabanci University, Sabanci Universitesi MDB Fakultesi, Orhanli Tuzla, Istanbul, 34956, Turkey, mkaya@sabanciUniversityedu

1 - Non-cooperative Joint Replenishment Games
Alper Sen, Bilkent University, Industrial Engineering, Bilkent, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr, Kemal Guler, Evren Korpeoglu

We consider the jointly replenishing n asymmetric firms that operate under an EOQ like setting using two non-cooperative games. In the first game, each firm bids how much he is willing to pay per unit of his replenishment and an intermediary determines the frequency of the joint orders that will recover his costs. In the second game, the intermediary sets the order frequency to maximize his revenues and the firms are able to opt out consequently. We characterize the equilibrium of both games.

2 - Assortment-based Cooperation Among Make-to-stock Producers
Yalcin Akcay, Asst. Professor of Operations Management, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, Turkey, yakcay@ku.edu.tr, Baris Tan

We consider the cooperation of two independent producers offering a combined assortment of products. We model the manufacturing facility of each producer as a make-to-stock system with dedicated servers. Producers use independent base stock policies to manage their own inventories and adopt discounted price contracts for the exchange of products. We investigate the impact of key problem parameters on the potential benefit from an assortment-based cooperation through a computational study.

3 - Sourcing From Multiple Unreliable Suppliers for Price-Dependent Demands
Ruixia Shi, University of Richmond, 1 Gateway Road, Richmond, VA, rxs048100@utdallas.edu, Annabelle Feng

This paper analyzes the combined pricing and ordering decisions under both supply and demand uncertainties. We prove that it is optimal to price low for a high inventory level, and the optimal replenishment strategy is a near re-order point policy. We further quantify and compare the implications of dynamic pricing and supplier diversification in the model.

4 - A Dynamic Inventory Model with the Right of Refusal
Sreekumar Bhaskaran, Asst. Professor, SMU-Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@cox.smu.edu, John Semple, Karthik Ramachandran

We consider a dynamic inventory model with general convex order costs and excess demand that can be backordered or refused by the firm. We show that the optimal policy is characterized by an optimal buy up to level that increases with the initial inventory level and an order quantity that decreases with the initial inventory level. More importantly, we show the optimal sales strategy is characterized by a critical threshold, a backorder limit, that dictates when to stop selling.

■ SA39

H-Sapphire E, Fourth Floor

Strategic Sourcing and Supplier Improvement

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu

1 - Supplier Diversification Strategies in the Presence of Yield Uncertainty and Buyer Competition
Yu Tang, Miami University, School of Business Administration, Coral Gables, FL, 33124, ytang@exchange.sba.miami.edu, Panos Kouvelis

In our paper we investigate the supplier diversification benefits in the presence of competition among sourcing firms (buyers) for multi-sourcing duopolists. We consider a two-stage supply chain with suppliers selling components to buyers producing and selling substitutable products. The suppliers' output processes are uncertain and modeled as having a proportional random yield. Buyers engage in a quantity-based Cournot competition. We study a two stage game between buyers where a sourcing strategy (supply structure) game is followed by a quantity game (output to the market).

2 - Mitigating Supply Risk: Dual Sourcing or Process Improvement?
Brian Tomlin, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States of America, brian.tomlin@tuck.dartmouth.edu

We explore two strategies for managing supply risk: (i) sourcing from multiple suppliers and (ii) exerting effort to improve supplier reliability. For both random capacity and random yield types of uncertainty, we characterize the firm's optimal improvement and procurement decisions and provide insights regarding the desirability of each strategy and the value of deploying both strategies in unison.

3 - Incentives to Collaborate in a Supply Chain Partnership
Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu, Serguei Netessine

We model partnership formation between a supplier and a manufacturer, who assembles the intermediate parts and sells the end product in the market. Among many reasons for close relationships cited in practice, in this paper we focus on possible production cost reduction through information sharing. We study how the uncertainties in both production cost and demand impact the integration decision.

4 - Supply Base Design for Supplier Competition and Investment under Cost and Demand Uncertainties
Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu

We analyze supply base design on both the number and capacities of suppliers, considering its effects on supplier competition and suppliers' investment of cost-reduction effort. We investigate the buyer's choice of the supply base structure under different environments, as well as when the buyer should pre-commit to prices or postpone capacity investment and with which supply base structure.

■ SA40

H-Sapphire H, Fourth Floor

Financial Services Student Paper Competition

Sponsor: Financial Services
Sponsored Session

Chair: Aparna Gupta, Assistant Professor, Lally School, RPI, 110 8th Street, Troy, NY, 12180, United States of America, guptaa@rpi.edu

1 - Estimating Expected Shortfall with Stochastic Kriging
Ming Liu, Ph.D. Candidate, Northwestern University, 2145 Sheridan Road, Room C231, Evanston, IL, 60208, United States of America, ming-liu@northwestern.edu, Jeremy Staum

We present an efficient two-level simulation procedure which uses stochastic kriging, a metamodeling technique, to estimate expected shortfall. The outer level simulates financial scenarios and the inner level of simulation estimates the portfolio value given a scenario. Because expected shortfall involves the scenarios that entail the largest losses, our procedure allocates more computational effort to inner-level simulation of those scenarios, which also improves computational efficiency.

2 - On Forecasting Volatility on Financial Markets
Ming Ye, Graduate Student, Johns Hopkins University, 3400 North Charles Street, Baltimore, MD, 21218, United States of America, mye@ams.jhu.edu, Shih-Ping Han

In this paper we present a method based on the combination of the Implied Volatility method and the GARCH model for forecasting the volatility of a stock price. In the method the volatility values obtained from the Implied Volatility method are incorporated into the GARCH model to compute the parameters of the model, which are, in turn, used to estimate the future volatility. Preliminary testings show very promising results.

3 - Extracting Implied Correlation From Index Options: A Statistical Approach
Romain Deguest, Columbia University, 500 W.112th Street, New York, NY, 10027, United States of America, rd2304@columbia.edu, Rama Cont

Starting from a prior distribution on correlation matrices, calibrated single-name dynamics and index vanilla prices, we propose a probabilistic construction yielding arbitrage-free prices that are consistent with both index and stock vanilla prices. A simple Monte Carlo algorithm is used for pricing and assessing model uncertainty of basket options. Sensitivities to vanilla option prices are used to built static hedging portfolios that minimize the risk of mispricing any exotic basket options.

4 - Timer Options: Pricing, Hedging and Implementation
Chenxu Li, PhD Student, Columbia University, 362 Riverside Drive 8A5, New York, NY, 10025, United States of America, cxli@math.columbia.edu

In this paper we investigate the pricing, hedging and implementation of timer call options, which are first traded in 2007 by Societe Generale as an interesting financial innovation. Under Heston's stochastic volatility model, we derived an explicit option pricing formula which can be regarded as a meaningful extension of Black-Scholes. We first formulate the problem of pricing timer option as a first hitting time problem. By conditioning, stochastic time change and other core techniques from stochastic analysis, we find that the variance process running on a variance clock, as advocated by H. Geman in [24], is equivalent to a Bessel process with constant drift in distribution. A closed form formula is thus derived via Bessel process theory and double Laplace transform etc. We designed an rotation counting algorithm to correctly evaluate the modified Bessel functions which appear in the Laplace transform formula. We also compare the implementation of quadrature with other methods including Monte Carlo simulation and numerical partial differential equations ADI schemes. We also propose a method to dynamically hedge timer call options using an auxiliary sequence of fixed maturity variance swap.

5 - Optimal Stopping Time Problem in House Investment Strategy
Qi Wang, Graduate Student, The Johns Hopkins University, Applied Math and Statistics, Baltimore, United States of America, qwang29@jhu.edu

Many people are interested in buying a second house as investment purpose. This paper will consider the optimal stopping time problem of the house investment strategy. Regime switching and connectivity of belief communication network will also be considered in this problem. Under special conditions, the analytical solution will be solved and numerical result will be given for regime switching and belief communication network property.

■ SA41

H-Sapphire L, Fourth Floor

Manufacturing

Contributed Session

Chair: David Shallcross, Telcordia Technologies, One Telcordia Drive, Piscataway, NJ, 08854, United States of America, davids@research.telcordia.com

1 - Predicting Demand Distribution if a Brand Is Removed From a Set of Available Brands
Henry Amato, Professor of Supply Chain Management, University of Nevada Reno, 1664 N. Virginia St, MS 028, Reno, NV, 89557, United States of America, hna@unr.edu, Igor Makienko

Although most shoppers have a preference for a particular brand, many will switch to another brand when their preferred brand is not displayed in a self-service setting. A model is presented for predicting the redistribution of demand among the remaining displayed brands when one of the brands has been removed from the shelf.

2 - A Multiobjective Evolutionary Computation Approach to Hazards Mitigation Design for Water Systems
Lufthansa Kanta, Graduate Teaching Assistant, Texas A&M University, WERC Building, Room 205R, 3136 TAMU, College Station, TX, 77843, United States of America, lufthansa_kanta@neo.tamu.edu, Emily Zechman, Kelly Brumbelow

A novel evolutionary computation-based multi-objective optimization algorithm is developed to design effective mitigation strategies for urban fire events for water distribution systems. Implementation of this methodology generates Pareto-optimal solution surfaces that express the trade-off relationship between fire damage, water quality, and least cost objectives.

3 - "Green" Modular Automotive Production Methods for Improved Efficiency and Profits
Todd Matsubara, Undergraduate, California State University Dominguez Hills, 1847 W 179th St., Torrance, CA, 90504, United States of America, tmatsubara1@cp.csudh.edu, j15Hamid Pourmohammadi

Revolutionary modular automotive production methods with integrated 'green' reverse logistics supply chain procedures. These environmentally friendly methods also significantly improve supply chain efficiency, profits, quality, production time, and after-sale customer satisfaction.

4 - Adapatively Distributed Fault Diagnosis
David Shallcross, Telcordia Technologies, One Telcordia Drive, Piscataway, NJ, 08854, United States of America, davids@research.telcordia.com, Hanan Luss, K. R. Krishnan, Arnold Neidhardt

We look at the problem of determining the set of faults responsible for an observed set of symptoms for large systems where the set of symptoms that would result from any single fault is known. We propose a method of adaptively partitioning the problem according to the set of observed symptoms, solving the resulting subproblems in parallel, and combining the results. We report on test results both for randomly generated problems and for problems generated for a wireless ad-hoc network model.

■ SA42

H-Sapphire P, Fourth Floor

Economics of Queues

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, United States of America, c.maglaras@gsb.columbia.edu

1 - Optimal Price-Lead Time Menus for Queues with Customer Choice: Priorities, Pooling, Strategic Delay

Philipp Afeche, University of Toronto, Rotman School, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, afeche@rotman.utoronto.ca, Michael Pavlin

We consider service provision over an M/M/1 facility to customers with heterogeneous and unobservable lead time preferences. Our customer model relaxes some standard assumptions from existing studies. We characterize the properties of the optimal price-lead time menu and the corresponding scheduling policies. We further specify how these properties depend on the capacity and on demand attributes.

2 - Service Rate Selection when Rational Customers do not Know the Service Value and Cost

Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

In this talk, I will address the following question: How does a firm strategically select the service rate in a market with rational customers for whom the value and the cost of the service are unknown?

3 - Revenue Maximization in a Market with Social Learning

Bar Ifrach, Doctoral Candidate, Columbia Business School, 3022 Broadway, Uris Hall, PhD office, New York, NY, 10027, United States of America, bi2118@columbia.edu, Costis Maglaras

We study the revenue maximization problem of a monopolist seller in a market with heterogeneous customers that learn the quality of the offered product by observing the sequential decisions of the customers that decided whether to buy the product earlier in time. We explore how this social learning aspect affects the seller's pricing decision, which, in turn, controls the revenue rate and the customers' learning speed.

4 - Pay-Per-Click Pricing in Advertising Networks: A Queuing Systems Approach

Sami Najafi-Asadolahi, PhD candidate, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, snajafi@london.edu, Kristin Fridgeirsdottir

Online advertising has become an important problem in recent years. We consider a web publisher that generates revenues from displaying advertisements on its website in an advertising network. The advertisers approach the web publisher, request their ads to be displayed in the website until clicked a certain number of times, and are charged according to the so-called pay-per-click pricing scheme. A key feature of advertising networks is that they only deal with immediate inventories. Hence, the operation of the web publisher can be modeled as a queuing system with no waiting spaces (loss system) where the advertising slots correspond to servers. This is a quite new queuing system. In particular, what distinguishes this system from other known multi-server systems is its special service mechanism; the service rate of each server constantly changes over time, which depends on the other active servers in the system. We derive a closed-form solution for the steady state probabilities of the number of advertisers in this system and determine the optimal price. We also show that imposing more complex conditions than the ones considered in this paper does not almost change the results from the pay-per-click system we consider. As a result our simplified system is a relatively accurate approximate for the behavior of more complicated real systems. In the end, our model provides managers of a publisher's advertising operation with insights on how to price base on, e.g., the number of slots on the website, the web traffic and the number of clicks that advertisers request.

■ SA43

H-Room 400, Fourth Floor

Spare Parts Supply Chains

Cluster: Supply Chain Models
Invited Session

Chair: Geert-Jan van Houtum, Professor, Eindhoven University of Technology, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, G.J.v.Houtum@tm.tue.nl

1 - Inventory Planning for Spare Parts Networks with Delivery Time Requirements

Ingrid Reijnen, PhD Student, Eindhoven University of Technology, P.O. Box 513, Pav E.13, Eindhoven, 5600 MB, Netherlands, I.C.Reijnen@tue.nl, Tarkan Tan, Geert-Jan van Houtum

Motivated by real-life, we introduce an inventory model for spare parts where we take delivery time requirements into account. Demand of a customer can be satisfied from multiple warehouses, but only if the customer can be reached from a warehouse within a time limit specified in its service contract. We develop a fast and accurate approximate algorithm to evaluate the performance of the network under given base stock levels and propose a fast and effective heuristic to set base stock levels.

2 - Integrating the Level of Repair Analysis (LORA) and Spare Parts Stocking Problems

Rob Basten, University of Twente, Fac. MB / OMPL, P.O. Box 217, Enschede, 7500 AE, Netherlands, r.basten@utwente.nl, Marco Schutten, Matthieu van der Heijden, Erhan Kutanoglu

When deciding how to maintain a capital good, a LORA determines which components to repair upon failure and which to discard, where in the repair network to do this, and where to place resources (e.g., test equipment). Then, we determine the amount of spare parts that guarantees a certain availability of the product. This sequential approach often leads to high spare parts costs. Using an integrated model, we achieve cost reductions of upto 15% on theoretical problem instances and a case study.

3 - Customer-centric Service Levels in Integrated Service Parts Logistics Problems

Erhan Kutanoglu, The University of Texas at Austin, ORIE Graduate Program, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, erhank@me.utexas.edu, Mehmet Candas

We analyze customer-centric time-based service levels in integrated service parts network design and inventory stocking problems. After introducing a non-linear mixed integer model that captures the interdependency between network design and inventory stocking, we provide two linearized integer formulations used to solve small and medium size problems. We then develop a Lagrangian-relaxation approach providing tight lower and upper bounds.

4 - A Distribution Inventory Model with Transshipments From a Support Warehouse

Johan Marklund, Associate Professor, Production Management, Lund University Box 118, Lund, SE-22100, Sweden, Johan.Marklund@iml.lth.se, Sven Axsater, Christian Howard

We consider a multi-echelon inventory model of a distribution system consisting of N retailers and a regional support warehouse, both being replenished from a central warehouse. In case of stockouts, the retailers receive transshipments from the support warehouse at an extra cost. Our model evaluates the system costs and optimizes the reorder points to achieve target fillrates for the end customers. The model results from collaboration with a large spare parts distribution company.

■ SA44

H-Room 402, Fourth Floor

Workforce Management in Service Operations

Sponsor: Service Science
Sponsored Session

Chair: Sheneeta White, University of St. Thomas, Opus College of Business, 1000 LaSalle Ave, Minneapolis, MN, 55403, United States of America, whit6237@stthomas.edu

1 - A Multi-objective Decision Support System for Workforce Training and Assignment

Gerald Evans, Professor, University of Louisville, Department of Industrial Engineering, University of Louisville, Louisville, KY, 40292, United States of America, gwevan01@louisville.edu, Gail W. DePuy

This presentation describes an interactive decision support system for determining workforce training and workforce job assignment for a large governmental facility. The system addresses three objectives: minimization of training costs, maximization of achievement of worker preferences with respect to desired training, and maximization of achievement of required skills for workers. The system allows for the input of preference information from the decision maker/manager involving his/her tradeoffs among the objectives.

2 - Assigning Professional Service Workers to Teams: A Mathematical Optimization Model

Vincent Hargaden, PhD Student, UCD Michael Smurfit Graduate Business School, Centre for Doctoral Research, Blackrock, Dublin, Ireland, vincent.hargaden@ucd.ie, Jennifer Ryan

We develop a mathematical model for professional service firms in which the employees of a firm are assigned to teams which deliver projects for customers. The model takes into consideration issues such as the technical (hard) and socio-cultural (soft) skills mix, geographical location and multiple team membership by workers. The output of the model is to recommend optimal team formation rules on an individual firm basis.

3 - Dynamic Service System Resource Management
Ray Strong, IBM Almaden Research, strong@almaden.ibm.com, Ruoyi Zhou, Isaac Councill, Toby Lehman

Service System Resources include, e.g., (1) geographic and skills based aggregations of people and (2) service business offerings. Each such set of resources constitutes a service portfolio. Cost and other risk characteristics of these portfolios vary with time at a pace significantly slower than that of, e.g., stock market equities. We discuss new techniques based on correlation trends for managing such portfolios to reduce risk.

4 - The Impact of Co-Production on Workforce Planning Decisions
Sheneeta White, University of St. Thomas, Opus College of Business, 1000 LaSalle Ave, Minneapolis, MN, 55403, United States of America, whit6237@stthomas.edu, Ralph Badinelli

This research investigates the effects of client intensity on planning decisions made by service firms. Dynamic programming is used to find optimal workforce and client intensity levels. Results show that for different types of service firms, different types of optimal policies exist.

■ SA45

H-Room 410, Fouth Floor

Product, Project and Process Management

Cluster: New Product Development
Invited Session

Chair: Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu

1 - Optimal Product Introduction for Multiple Generations with Dynamic Pricing
Janice Carrillo, Associate Professor, University of Florida, P.O. Box 1171769, Gainesville, FL, 32611-7169, United States of America, janice.carrillo@cba.ufl.edu, Michelle Seref

When planning for the introduction of a stream of new products into the marketplace, managers must consider both the timing and dynamic pricing decisions to determine an appropriate entry strategy. In this paper, we consider multiple generations of a single product with sales as a function of both price and diffusion. In addition to solving for the optimal pricing policy for each generation, we find the optimal number of generations that the firm should produce within a finite planning horizon.

2 - Current Practices in Videogame Project Management
Edward G. Anderson Jr., Associate Professor, University of Texas at Austin, 1 University Station B6500, CBA 3.430, Austin, TX, 78712, United States of America, Edward.Anderson@mccombs.utexas.edu, Geoffrey G. Parker, John Paul Macduffie

We present results from interviews with project managers at 12 different firms in the videogame industry, which is notorious for late and over-budget projects. Using qualitative data, we seek to answer the following questions: (1) Is managing videogame projects different from managing other software projects? (2) What are the implications of these differences—if they exist—for managing the videogame software supply chain? (3) and how are these practices evolving over time?

3 - Production and Process Investment Decisions for a Startup
Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu, Fehmi Tanriserver, Sinan Erzurumlu

We examine the long-term process investment and short-term production decisions of a startup under bankruptcy risk and a debt constrain. We show that bankruptcy risk may either induce aggressive or conservative investment behavior, along with a deviation from monopoly production quantity depending on market conditions, compared to the case with no bankruptcy risk. On the other hand, a tight debt capacity always reduces the propensity to invest and leads to more conservative production decisions.

4 - Exploring Core-Periphery Structures in Complex Software Products
Alan MacCormack, Visiting Associate Professor, MIT Sloan School of Management, 50 Memorial Drive, E52, Cambridge, MA, 02142, United States of America, alanmac@mit.edu

Prior work argues that technical systems possess a "Core-Periphery" structure, in which tightly-coupled "Core" components are surrounded by loosely-coupled "Peripheral" components. However, little work has explored if such structures are observed in practice, or what factors dictate the size and growth of the core. We examine these questions using data from over 1,000 software systems. We show that Core-Periphery structures dominate, and reveal data on the size and composition of the cores.

■ SA46

H-Room 411, Fourth Floor

Knowledge Transfer Across Product, Individual, and Organizational Boundaries

Sponsor: Technology Management
Sponsored Session

Chair: Erica Fuchs, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 131E, Pittsburgh, PA, 15213, United States of America, erhf@andrew.cmu.edu

1 - Knowledge Transfer Across Individuals and Products in Offshore Manufacturing
Carolyn Denomme, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 131E, Pittsburgh, PA, 15213, United States of America, cdenomme@cmu.edu, Linda Argote, Dennis Epple, Erica Fuchs

This talk provides new insights into the significance of product mix and turnover rates on organizational learning. Analysis draws on three years of detailed production data on one facility's 1,339 optoelectronic product variations and 7 years of human resource data of the same facility's 11,742 employees.

2 - Generative Mechanisms of Inter-Firm Knowledge Access, Mobility, and Organizational Ties
Rafael Corredoira, Assistant Professor, University of Maryland, Robert H. Smith School of Business, 4557 Van Munching Hall, College Park, MD, 20742, United States of America, rcorredo@rhsmith.umd.edu

This paper explores whether two generative mechanisms (enduring personal ties and attention-focusing routines) facilitate access to knowledge across firm boundaries that result in a form of innovation: technical solutions granted patents. It departs from extant literature on inter-organizational knowledge transfer by actually testing and providing evidence supporting both generative mechanisms underlying the knowledge access through inventor mobility phenomenon.

3 - Intellectual Human Capital and Strategic Alliances: Complements or Substitutes?
Kwanghui Lim, Assistant Professor, k@kwanghui.com, Annapoornima Subramanian, Pek-hooi Soh

We examine how firm and network-level factors shape innovation. At the firm level we categorize human capital into (1) pure scientists (2) bridging scientists and (3) pure inventors. At the network level, university alliances are distinct from inter-firm alliances. Using patent, publication and alliance data on 435 biotechnology firms, we show that pure and bridging scientists substitute university alliances, whereas bridging scientists and pure inventors complement firm alliances.

4 - Uncertainty, Learning, and the Termination of Bad Projects
Oliver Baumann, University of Munich, Dirk Martignoni

Organizations often fail to terminate bad projects. Traditionally, this phenomenon has been framed as a problem of escalation of commitment, suggesting that bad projects should be terminated sooner than later. We use a simulation model of organizational learning to explore the robustness of this argument. We show that under conditions of high uncertainty, it can actually become rational to pursue projects that have a low or even negative estimated value, if an organization does not want to prematurely abandon too many (potentially good) ideas. This result arises as the value of new ideas is often underestimated, and errors of underestimation may be hard to correct in experiential learning processes.

■ SA47

H-Room 412, Fourth Floor

Applications in Evacuation and Emergency Management

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Eva Regnier, Associate Professor, Naval Postgraduate School, 699 Dyer Road, Monterey, CA, 93943, United States of America, eregnier@nps.edu

1 - Investment Decision between Infrastructure and Forecasting in the Face of Hurricane Risk
Seong Dae Kim, Ph.D. Candidate, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States of America, sdkim@tamu.edu, J. Eric Bickel

In planning for the hurricane, society must decide whether to invest in the ability to evacuate more speedily or in improved forecasting technology to better predict the track and intensity of the event. We use DP and Markov processes to

model the interaction between the emergency response system and the emergency forecasting system. Modeling changes in the speed of evacuation and in the accuracy of forecasting allows the determination of an optimal mix of these two investments.

2 - Ensayo: A Virtual Emergency Operations Center for Training and Research

Gregory R. Madey, University of Notre Dame, 384 Fitpatrick Hall, College of Engineering, Notre Dame, IN, 46556, United States of America, gmadey@nd.edu, Irma Becerra-Fernandez, Michael Prietula, Cynthia Nikolai

We describe Ensayo: a socio-cognitive-technical simulator and training facility for upper level emergency managers and a tool for cognitive scientists to study the decision making process under emergency conditions. In particular, we describe how the underlying architecture accommodates the various learning requirements inherent in a dynamic, evolving, and unique organizational structure situated in a highly variable complex threat environment.

3 - Impact of Improving Intensity Forecasts

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

Improving intensity forecasts - which have been stalled for 20 years - is one of the top priorities for the tropical-cyclone research community. How much would likely reductions in hurricane intensity forecast error reduce the rate of casualties and unnecessary evacuations?

4 - A Plan for Evacuation of Disabled People in the Face of a Disaster

Aruna Apte, Assistant Professor, Naval Postgraduate School, 555 Dyer Rd, Monterey, CA, 03043, United States of America, auapte@nps.edu, Susan Heath

We investigate the problem of evacuation of the disabled for short-notice disasters with traversable roads. The developed optimization model generates routes in an optimal sequence to maximize evacuees within the constraints. The routes assign each disabled person to a vehicle that will accommodate their level of disability and complete the evacuation within the allotted time. The problem assumes the existence of a list of disabled people needing evacuation with their location and disability.

■ SA48

H-Sapphire Green Room, Fourth

Research Advances in the Service Science and Service-Oriented Solutions

Sponsor: Service Science
Sponsored Session

Chair: Haluk Demirkan, Assistant Professor, Arizona State University, P.O. Box 874606, Tempe, AZ, 85287, United States of America, Haluk.Demirkan@asu.edu

1 - The Role of Private Health Records in Healthcare Technology Adoption

Subhajyoti Bandyopadhyay, Assistant Professor, University of Florida, 351 Stuzin Hall, P.O. Box 117169, Gainesville, FL, 32611, United States of America, shubho.bandyopadhyay@cba.ufl.edu, Zafer Ozdemir

The 2009 stimulus bill provides significant incentives for providers to digitize their records, but unless the records are made interoperable, the full potential of EHR will never be realized. The emergence of the independent PHR platforms is a major development towards the cause of interoperable health records. Not only do these platforms have a vested interest in facilitating interoperability, but they also can help promote the adoption of EHR among healthcare providers.

2 - From Green Computing to Sustainable IT Services: Exploring the Dimensions of a New Discipline

Robert Harmon, Professor of Marketing and Technology Management, Portland State University, P.O. Box 751, Portland, OR, 97207, United States of America, harmonr@pdx.edu, Haluk Demirkan

Reducing energy costs and carbon footprints of large data centers is the driving force for green computing. Computing resources are used more efficiently while productivity is maintained or improved. However, green computing is only one dimension of a much larger concept. This paper surveys the literature on the emerging discipline of sustainable IT services, defines its dimensions, and offers insights on its role as an essential enabler of effective corporate sustainability strategy.

3 - Sustainability in Logistics Services: Trends and Issues

Bülent Catay, Associate Professor, Sabanci University, FENS, Tuzla, Istanbul, 34956, Turkey, catay@sabanciUniversityedu

Environmental concerns in today's developed societies force organizations to measure, monitor, and control the environmental impact of their activities. Governments are considering targets for reduced carbon emission and energy consumption, better traceability, reduced traffic congestion, and other environmental measures in logistics services. A "green evolution" is in force. We will review recent trends and issues in green logistics services.

4 - Leveraging the Capabilities of Adaptive Service Ecosystems

Haluk Demirkan, Assistant Professor, Arizona State University, P.O. Box 874606, Tempe, AZ, 85287, United States of America, Haluk.Demirkan@asu.edu

For service-orientation, companies must co-create their offerings with customers, break siloed business processes into modular services that can be reused on-the-fly in loosely-coupled dynamic business processes or out-tasked to external service providers, and executed by service oriented architectures and infrastructures. It is difficult to predict the organizational and technical impacts, understand the critical issues, or perform rigorous research on the service-oriented-computing.

■ SA49

H-Room 300, Third Floor

Managing Complex Projects

Cluster: Project Management
Invited Session

Chair: Ted Klastorin, Professor, University of Washington, Department of ISOM, Box 353200, Seattle, WA, 98195-3200, United States of America, tedk@u.washington.edu

1 - On the Value of Flexibility in Multi-stage Projects

Mohsen Sharifanni, ISOM Department, University of Washington, Box 353200, Seattle, WA, 98195-3200, United States of America, mohsens@u.washington.edu, Gary Mitchell, Issariya Sirichakwal, Ted Klastorin

In this paper, we compare a purely reactive schedule to a fixed baseline schedule in a two-stage project with stochastic task durations. Specifically, we study the difference between these different types of schedules and show what factors are most critical in determining the value of flexibility offered by a purely reactive schedule. We extend our results to more complex projects and discuss the managerial implications.

2 - Optimal Strategies for New Product Development Projects in a Duopoly Market

Aysun Ozler, PhD Student, University of Washington Business School, Mackenzie Hall Box 353200, Seattle, WA, 98195-3200, United States of America, aysun@u.washington.edu, Yong-Pin Zhou, Ted Klastorin

We study the duopoly competition where each firm develops a new product competing with each other. Moreover, each firm has to determine the design level and the price of its product. One firm is the leader and the other one is the follower. We also consider the possibility of information leakage to the market before the leader firm releases their product and study the impact of the information leakage on each firm's decisions and profit outcomes.

3 - A Real Option Model for Evaluating New Drug Discovery Projects

Yu-Ting Li, BA, NTU, 1, Sec. 4, Roosevelt Road, Taipei, Taiwan - ROC, r96741017@ntu.edu.tw, Jy Yu

Real options approach is frequently used for evaluating R&D projects. This paper aims to apply real options approach to aid the decision-making at the end of new drug discovery process. External and internal factors influencing the value of a pharmaceutical research project, including market competition, growth opportunity of the project, and probability of success of clinical trials, are investigated. Options to invest, to suspend, and to abandon are simulated under different scenarios.

4 - A Joint Optimization Framework for IT Portfolio and Program Management

Robert Chiang, Associate Professor, Fordham University, 441 E. Fordham Road, Bronx, NY, 10458, United States of America, ichiang@fordham.edu, Manuel Nunez

Firms increasingly are using application portfolio management to maximize returns from IT investment while ensuring alignment with the overall strategic vision. Projects of similar characteristics and objectives are then grouped to share resources and to minimize architecture and development risks. We propose a procedure to yield the highest risk-adjusted benefits while ensuring that project sequence and personnel assignment satisfy schedule dependencies and resource constrains.

■ SA51

H-Room 303, Third Floor

Computational Optimization Methods and Applications

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Jiawang Nie, UCSD, 9500 Gilman Drive, La Jolla, CA, United States of America, njw@math.ucsd.edu

1 - An Affine-scaling Interior-point Method for Continuous Knapsack Constraints

Hongchao Zhang, Department of Mathematics, Louisiana State University, Baton Rouge, LA, hozhang@math.lsu.edu

A gradient based affine-scaling algorithm for continuous knapsack constraints will be presented. This algorithm has the property that each iterates lie in the interior of the feasible set and is more suitable for large dimensional optimization problems where the Hessian of the objective function is a large, dense, and possibly ill-conditioned matrix. Global and local linear convergence of the algorithm will be discussed. Numerical results will be also reported.

2 - Solving Graph Bisection Minimization Problems Using Convex Quadratic Relaxations

Dzung Phan, University of Florida, 358 Little Hall, P.O. Box 118105, Gainesville, FL, 32611-8105, United States of America, dphan@ufl.edu, William Hager

We present an exact algorithm for solving the node and edge weighted graph partitioning problem. The algorithm is based on a continuous quadratic formulation of the problem. Necessary and sufficient optimality conditions for a local minimizer of the quadratic program are introduced. Lower bounds for the branch and bound algorithm are obtained by replacing the concave part of the objective function by the best affine underestimator. Numerical results show the effectiveness of our method.

3 - A Convergence Theorem for Solving the SQP System in SSM

Ning Guo, Student, University of Florida, Gainesville, FL, guoning@ufl.edu, William Hager

SSM(sequential subspace method) is an iterative method used to solve the trust region subproblem. A convergence theorem is developed concerning how precisely we should solve the SQP(sequential quadratic programming) system in each iteration in order to obtain an at least linear convergence for the non-degenerate case. We shall look at some numerical results.

■ SA52

H-Room 304, Third Floor

Marketing Strategies and Tools

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Rachel Chen, Assistant Professor, University of California at Davis, rachen@ucdavis.edu

1 - Overselling in a Competitive Environment: Boon or Bane?

Lim Wei Shi, Associate Professor, NUS Business School, 1 Business Link, National University of Singapore, Singapore, Singapore, weishi@nus.edu.sg

We study the practice of overselling in a competitive environment where late arriving consumers value the good higher than early arriving ones but the formers arrival is uncertain. We show that overselling is a dominant strategy. However, it can lead to a prisoners dilemma situation in which all firms are worse off overselling unless demand from the late consumers far exceeds the supply and there is a sufficiently high profit margin from reselling.

2 - Optimal Pricing and Referral Reward Programs under Competition

Run Niu, Webster Universtiy, Business Department, St. Louis, United States of America, runniu68@webster.edu, Paul Messinger

Pricing has been well known as an effective way of managing demand. Referral reward programs are an increasingly popular way to manage consumer referrals with incentives. This paper examines joint optimal pricing and referral reward programs for two competing firms selling substitutable products/services to a common customer pool. The paper provides managerial insights to help managers to determine optimal price and the timing strategy and the level of a reward.

3 - Discount Pricing and Market Segmentation for Source Reduction via Consumer Reuse

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu, Michael Pangburn

We focus on the use of source reduction via customer input reuse in conjunction with associated product price and discount decisions. Our demand model reflects rational consumers who are heterogeneous with respect to reservation prices and their assessment of the inconvenience associated with input reuse. We found that the optimal policy can be used not only to reduce input costs, but also to increase revenues by invoking demand from the consumers who would not purchase the product otherwise.

4 - Group Buying of Competing Retailers

Rachel Chen, Assistant Professor, University of California at Davis, rachen@ucdavis.edu, Paolo Roma

Under group buying, quantity discounts are offered based on the buyers' aggregated, rather than individual quantity. While previous studies focus on the benefits buyers enjoy from aggregating their demand, we show that buyers might get hurt from such cooperation. We consider a two-level distribution channel, with a single manufacturer and two retailers who compete for end customers. We show that under competition, retailers may not always prefer cooperation in purchase.

■ SA53

H-Room 305, Third Floor

Mixed Integer Programming: Applications

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Alper Atamturk, Professor, UC Berkeley, 4175 Etcheverry Hall MC 1777, Berkeley, CA, 94720, United States of America, atamturk@berkeley.edu

1 - Mixed Zero-One Linear Programs under Objective Uncertainty: A Cross Moment Model

Karthik Natarajan, National University of Singapore, Department of Mathematics, Singapore, 117543, Singapore, matkbn@nus.edu.sg, Zheng Zhichao

We develop a cross moment model based on completely positive programs for mixed 0-1 linear programs under objective uncertainty. The model captures mean-covariance information without assuming the exact probability distribution. The usefulness of the model is explored in several applications including order statistics, project management and newsvendor networks. The generality of the model opens up an interesting dimension for research in stochastic optimization models.

2 - 1.5-Dimensional Rectangle Packing and its Applications in the Semiconductor Industry

Ali Ekici, PhD Student, Georgia Institue of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, aekici@isye.gatech.edu, Bulent Basaran, Pinar Keskinocak

Motivated by the chip design problem in the semiconductor industry, given a set of rectangles with specified horizontal positions, we need to decide about the vertical positions of the rectangles to minimize the total height of the resulting placement. We show that the problem is NP-hard and propose an integer programming formulation. We also develop heuristics that are efficient and effective, finding near-optimal solutions.

3 - A Benders Approach to a Transportation Network Design Problem

Ben Peterson, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15232, United States of America, benp@cmu.edu, Michael Trick

We apply a Benders decomposition technique to a truck routing and delivery problem, in which our master problem iteratively generates minimum-cost sets of routes, and our subproblem finds sets of deliveries for which the current route set does not have capacity. We find that by iteratively adding constraints to the master problem which ensure capacity for such a delivery set of minimum size, we generate optimal solutions much faster than comparable algorithms for many problem instances.

4 - The Maximum Weight Triangle-free Simple 2-matching Problem in Subcubic Graphs

Yanjun Li, Purdue University, 403 W. State Street, West Lafayette, United States of America, li14@purdue.edu, David Hartvigsen

A simple 2-matching in a graph is a subgraph all of whose vertices have degree 1 or 2. For graphs with degree at most three, we give a complete description of the convex hull of incidence vectors of triangle-free simple 2-matchings and a strongly polynomial time algorithm for finding a triangle-free simple 2-matching with maximum weight. Our system uses a generalized blossom inequality with {0, 1, 2}-coefficients. This problem is related to the travelling salesman problem.

■ SA54

H-Room 306A, Third Floor

Random Sampling and Convex Optimization

Sponsor: Optimization/Networks
Sponsored Session

Chair: Santosh Vempala, Distinguished Professor of Computer Science, Georgia Tech, Atlanta, United States of America, vempala@cc.gatech.edu

1 - Random Walks on Polytopes and an Affine Interior Point Method for Linear Programming

Hariharan Narayanan, Graduate Student, University of Chicago, 1100 E 58th Street, Chicago, 60637, United States of America, hari@cs.uchicago.edu, Ravi Kannan

Let K be an n dimensional polytope defined by m linear inequalities. We give a new Markov Chain algorithm to draw a nearly uniform sample from K. The underlying Markov Chain is the first to have a mixing time that is strongly polynomial when started from a "central" point. Using related ideas, we develop a randomized affine algorithm for linear programming that produces an approximately optimal point in polynomial time with high probability.

2 - Sampling Harmonic Concave Functions

Karthekeyan Chandrasekaran, Georgia Institute of Technology, 2115 KACB, 266, Ferst Drive, Atlanta, GA, 30332, United States of America, karthe@cc.gatech.edu

Efficient algorithms for sampling rely on good isoperimetry which is known to hold for arbitrary logconcave densities. In this talk, we will characterize convexity-like conditions on the density function that imply good isoperimetry. Further, we will present an efficient algorithm for sampling according to density functions satisfying this condition, over a convex set. As a consequence, we obtain an efficient algorithm to sample according to the Cauchy distribution function over a convex set.

3 - Towards Practical Sampling of Convex Bodies in High Dimensional Spaces

Merrick Furst, Professor of Computer Science, Georgia Tech, United States of America, merrick@cc.gatech.edu, Santosh Vempala

We report on progress towards a practical method for sampling convex bodies in n-space when such bodies are given via linear and semi-definite constraints. Sampling is the basic step in algorithms for volume computation and convex optimization. Remarkable breakthroughs have reduced the complexity of sampling to n^4. However, convergence is dominated by big constants and is not practical. We describe an intriguing new algorithm together with promising evidence that it leads to practical sampling.

■ SA55

H-Room 306B, Third Floor

Local Search in Combinatorial Optimization

Sponsor: Optimization/Networks
Sponsored Session

Chair: Renato F. Werneck, Researcher, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, renatow@microsoft.com

1 - Fast Local Search for Steiner Trees in Graphs

Renato F. Werneck, Researcher, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, renatow@microsoft.com, Eduardo Uchoa

We present efficient algorithms that implement four local searches for the Steiner problem in graphs: vertex insertion, vertex elimination, key-path exchange, and key-vertex elimination. In each case, we show how to find an improving neighboring solution (or prove that none exists) in O(m log n) time on graphs with n vertices and m edges. Besides the theoretical interest, our results have practical impact: these local searches have been shown to find good-quality solutions in practice.

2 - GRASP with Evolutionary Path-relinking for the Antibandwidth Problem

Mauricio G. C. Resende, Lead Member of Technical Staff - Research, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com, Abraham Duarte, Rafael Marti, Ricardo M. A. Silva

We propose an integer programming (IP) formulation and several heuristics based on GRASP and path-relinking for the antibandwidth problem (AP). In the AP, one is given an undirected graph with N nodes and must label the nodes such that each node receives a unique label from the set (1, 2, ..., N), where among all adjacent node pairs, the minimum difference between the node labels is maximized. We present computational results using a commercial IP solver and the heuristics.

3 - Local Searches for PBX Telephone Migration Scheduling

Diogo Andrade, Software Engineer, Google Inc., 76 Ninth Ave, 4th Floor, New York, NY, 10011, United States of America, diogo@google.com, Mauricio G. C. Resende

The PBX telephone migration problem consists of migrating telephone numbers from an old PBX system to a newer one over a time horizon. A penalty, assigned to the each connected pair of phones, is incurred if the pair is migrated in different time periods. The objective is to assign phones to time periods such that no more than a given number of phones is assigned to any period and the total penalty is minimized. We present three local search heuristics for this problem.

■ SA56

H-Room 307, Third Floor

Applications in Mixed-integer Nonlinear Programming

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Carl Laird, Assistant Professor, Texas A&M University, MS 3122, TAMU, College Station, TX, 77843, United States of America, carl.d.laird@gmail.com

1 - Globally Optimizing an Extended Pooling Problem

Christodoulos Floudas, Stephen C. Macaleer '63 Professor in Engineering and Applied Science, Princeton University, Department of Chemical Engineering, Princeton University, Princeton, NJ, 08540, United States of America, floudas@princeton.edu, Ruth Misener

The extended pooling problem appends the nonconvex, piecewise-defined Environmental Protection Agency (EPA) Complex Emissions constraints to the problem of maximizing profit given a network of input feed streams, intermediate nodes, and final products. We demonstrate the superior tightness of problem relaxations using piecewise-linear and edge-concave underestimators. We also integrate the relaxations into a global optimization algorithm and present extensive computational results.

2 - Using Redundancy to Strengthen the Relaxation of Nonconvex MINLPs

Juan Ruiz, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, United States of America, jpruiz@andrew.cmu.edu, Ignacio Grossmann

In this paper we present a strategy to improve the relaxation for the global optimization of nonconvex MINLPs. The main idea consists in recognizing that each constraint or set of constraints in the model carries information. When these constraints are relaxed some of this information is lost. Adding redundant constraints that recover that information will strengthen the relaxation. We propose a methodology to find such redundant constraints based on engineering knowledge and physical insight.

3 - A New Framework for Solving Nonlinear Programs

Ashutosh Mahajan, PhD Candidate, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, asm4@lehigh.edu, Sven Leyffer

We describe a new solver for nonlinear programs that deploys as its components both active set and interior point methods. Computational results on benchmark instances are also provided.

4 - An MINLP Formulation for Estimating On-Off Seasonal Transmission in Infectious Disease Models

Carl Laird, Assistant Professor, Texas A&M University, United States of America, carl.laird@tamu.edu

Seasonal drivers of infectious disease spread appear to be correlated with school terms. Here, we present an MINLP formulation and solution approach for estimating on-off seasonal transmission patterns for nonlinear infectious disease models. This approach is tested using childhood disease data for measles and chickenpox.

■ SA57

H-Room 308, Third Floor

OR Models in Health Care Planning

Sponsor: Health Applications
Sponsored Session

Chair: Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, Canada, steven.shechter@sauder.ubc.ca

1 - Flexibility in Primary Care

Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu, Ana Muriel, Jan Hippchen

Timely access and continuity of care are two key measures for any primary care practice, and they are often in conflict. Timely access refers to the ability of practices to provide patients an appointment as soon as possible, while continuity refers to the ability of patients to see their personal physician as often as possible. We present a stochastic dynamic programming framework to evaluate the benefits of physician flexibility in a practice and its implications for timeliness and continuity.

2 - Incentive-based Surgery Scheduling: Determining Optimal Number of Surgeries

Mehmet Begen, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, mbegen@ivey.uwo.ca, Christopher Ryan

We study the problem of determining number of surgeries for an operating room (OR) block where surgery durations are random, there are significant idle and overtime costs for an OR and the incentives of the parties involved (hospital and surgeon) are not aligned. We adapt a game theoretical setting, present some empirical findings and suggest, under reasonable assumptions, a payment scheme that the hospital may offer to the surgeon to reduce its (idle and especially overtime) costs.

3 - Strategic Planning of Radiation Therapists at the BC Cancer Agency

Greg Werker, University of British Columbia, greg.werker@sauder.ubc.ca, Martin Puterman, Mike Darud

The Vancouver Centre of the British Columbia Cancer Agency (BCCA) employs 80 radiation therapists who work in a number of different areas. Our integer programming (IP) model is used to create a five-year plan for all therapists, balancing experience against various scheduling considerations. We use additional techniques to handle variability to create a more robust plan. While the focus of this presentation is on the BCCA, it could be extended to other staff planning applications in health care.

4 - A Simulation Optimization Model for Long Term Residential Care Capacity Planning

Yue Zhang, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, yue.zhang@sauder.ubc.ca, Martin Puterman, Derek Atkins, Matthew Nelson

This talk concerns optimizing capacity levels in our study of residential capacity planning for the Vancouver Island Health Authority (VIHA) for a long time period. The problem is described in a parallel talk, in this talk we focus on how we used the simulation to determine capacity levels that meet service criteria.

■ SA58

H-Room 309, Third Floor

Scheduling and Logistics

Cluster: Scheduling
Invited Session

Chair: Xiangtong Qi, Professor, HKUST, HKUST Academic Building 5540, Kowloon, Hong Kong, Hong Kong - PRC, ieemqi@ust.hk

1 - Stochastic Programming Approach to Process Flexibility Design

Ho-Yin Mak, The Hong Kong University of Science and Technology, Department of IELM, HKUST, Clear Water Bay, Hong Kong, Hong Kong - PRC, hymak@ust.hk

Service and manufacturing firms often attempt to mitigate demand-supply mismatch risks by deploying flexible resources that can be adapted to serve multiple demand classes. It is critical to evaluate the trade-off between the cost of investing in such resources and the resulting benefits. In this paper, we show that the heavily advocated "chaining" heuristic can perform badly when resources are not perfectly flexible, and propose an alternative stochastic programming heuristic.

2 - Scheduling of Operations in Emergence Room with Different Classes of Patients

Guohua Wan, Professor, Shanghai Jiao Tong University, Shanghai, Shanghai, China, ghwan@sjtu.edu.cn

We consider a scheduling problem of operations in emergence room with two classes of patients and the processing time of a patient is time dependent. We model the problem with two-agent scheduling framework, and consider the models with single machine and parallel machines, and with the regular objectives. We analyze the computational complexity of the models and develop polynomial time algorithms or heuristic algorithms for such models.

3 - Pickup and Delivery Network Segmentation Using Contiguous Geographic Clustering

Ahmad Jarrah, Associate Professor, The George Washington University, Department of Decision Sciences, School of Business, Washington, DC, 20052, United States of America, jarrah@gwu.edu, Jonathan Bard

We address the problem of partitioning a service region into disjoint work areas with pickups and deliveries made throughout the day. For a fleet of homogeneous vehicles, a given set of customers, and expected demand for service, the objective is to find the least number of clusters that satisfy geometric and capacity constraints. The problem is modeled using a set-covering formulation, and solved with a column generation heuristic. Results are presented for data sets from a major carrier.

4 - Vehicle Scheduling with Combinable Delivery and Pickup

Xiangtong Qi, Professor, HKUST, HKUST Academic Building 5540, Kowloon, Hong Kong, Hong Kong - PRC, ieemqi@ust.hk, Chung-Yee Lee

Motivated by the logistics operations in an express delivery company, we develop and study a new scheduling model where each job needs two operations, delivery and pickup. The two operations can be processed either separately or in combination. The objective is to minimize the total weighted completion time of the delivery subject to a time buffer constraint on the pickup. The work is partially supported by Hong Kong RGC and NSFC joint research scheme (project No. N-HKUST612/6).

■ SA60

H-Room 311, Third Floor

Interior-point Methods

Cluster: Large Scale Optimization (In Honor of Jean-Louis Goffin)
Invited Session

Chair: Samir Elhedhli, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, elhedhli@uwaterloo.ca

1 - Bi-parametric Convex Quadratic Optimization

Tamas Terlaky, Professor, Chair, Lehigh University, Department ISE, H. Mohler Lab, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu, Alireza Ghafari Hadigheh, Oleksandr Romanko

We consider the Convex Quadratic Optimization problem with simultaneous perturbation in the right-hand-side of the constraints and the linear term of the objective function with different parameters. The regions with invariant optimal partitions are investigated as well as the behavior of the optimal value function on the regions. Identifying these regions can be done in polynomial time in the output size. An algorithm for identifying all invariancy regions is presented.

2 - Interior-Point Methods for Integer Programming: The ACCPM Approach

Samir Elhedhli, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, elhedhli@uwaterloo.ca

This talk highlights the use of interior point methods in solving integer programming through the Analytic Centre Cutting Plane Method (ACCPM). Heuristic, Branch-and-price, branch-and-cut, and Benders decomposition algorithms will be presented that compete with LP-based approaches.

3 - An L1 Elastic Interior-Point Method for MPCCs

Zoumana Coulibaly, PhD Student, Ecole Polytechnique de Montreal and GERAD, 2500, chemin de Polytechnique, Montreal, Qc, h2e2g5, Canada, zoumana.coulibaly@polymtl.ca

Our interior-point algorithm consist of an elastic formulation of the L1-penalty merit function for mathematical programs with complementarity constraints. The method naturally converges, at a sub-quadratic local convergence rate, to a strongly stationary point or delivers a certificate of degeneracy without recourse to second-order intermediate solutions. Numerical results on a standard test set illustrate the efficiency and robustness of the approach.

4 - Solving Unconstrained Nonlinear Programs with ACCPM

Ahad Dehghani, McGill University, 1001 Sherbrooke west, Montreal, H3A 1G5, Canada, ahad.dehghani@mcgill.ca, Jean-louis Goffin, Dominique Orban

ACCPM and proximal ACCPM are well known techniques for convex programming problems. We propose a sequential convex programming method based on ACCPM and convexification techniques to tackle unconstrained problems with a non-convex objective function.

■ SA61

H-Room 312, Third Floor

Location Analysis Applications

Sponsor: Location Analysis
Sponsored Session

Chair: Rajan Batta, Professor, University at Buffalo (SUNY), Department of Industrial & Systems Engineering, 410 Bell Hall, Buffalo, NY, 14260, United States of America, batta@eng.buffalo.edu

1 - Location Reliability Problems - Linear Case

Mozart Menezes, Professor, MIT-Zaragoza Logistics Center, Avda Gomez Laguna 25, 1a Planta, Zaragozza, Spain, mmenezes@zlc.edu.es, Oded Berman, Dmitry Krass

We analyze the problem of locating two facilities prone to failure on a line. A variety of objectives is analyzed both under independent and correlated failure scenarios. The total cost is decomposed into informational, reliability and locational components. Interesting insights about optimal location patterns under different scenarios are obtained.

2 - Resizing, Opening, and Closing Rural Schools in Chile

Robert Dell, Professor and Chair, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93940, United States of America, dell@nps.edu, Pedro Donoso, Andres Weintraub, Fernando Araya, Consuelo Zuniga, Francisco Martinez, Vladimir Marianov

This talk describes a linear integer program embedded in a geographically information system developed for the Chilean Ministry of Education. There are over 4500 rural elementary and secondary schools located throughout Chile. Are these schools correctly located and sized, should new schools be opened, what schools should be closed? These are some of the questions the Ministry uses the system to address. We report computational experience, challenges, and insights gained during implementation.

3 - Determining Optimal Loiter Paths for UAVs

Noah Bednowitz, University at Buffalo (SUNY), 339b Bell Hall, Buffalo, NY, 14260, United States of America, NHB@Buffalo.edu, Rakesh Nagi, Rajan Batta

We consider a system of unmanned aerial vehicles (UAVs) assigned to respond to future surveillance requests. Idle UAVs are repositioned on a loiter path so as to minimize the expected time to respond to the next target. Solution algorithms based on dynamic programming approximations are developed and tested for a variety of algorithmic and system factors.

■ SA62

H-Room 313, Third Floor

Potpourri of Behavioral Operations

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Kenneth L. Schultz, Associate Professor, University of Alberta School of Business, Business Building, Edmonton, AB, T6G 2R6, Canada, klschult@bus.ualberta.ca

1 - An Empirical Investigation of the Depth of Adoption of the LEED Green Building Standards

Suresh Muthulingam, Acting Assistant Professor, Cornell University, 401P Sage Hall, Johnson Graduate School of Management, Ithaca, NY, 14853-6201, United States of America, suresh.muthulingam.2010@anderson.ucla.edu, Charles Corbett

We examine four issues related to the depth of adoption of the LEED standards for green buildings, using a database of 721 LEED certified buildings. First, we find that depth of adoption is influenced by the certification levels in the standards. Second, we find that depth of adoption increases over time. Third, we find that nonprofit organizations adopt it more deeply than other types of organizations. Finally, we find that deeper adoption is associated with longer project completion times.

2 - The Effect of Consumer Perceptions of Remanufactured Products on Competitive Strategies

Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, 30308, United States of America, vishal.agrawal@mgt.gatech.edu, Atalay Atasu, Koert Van Ittersum

We experimentally investigate the effect of consumer perceptions of remanufactured products and analytically study its impact on an OEM's competitive strategies. We find that the perceived value of new products decreases when the OEM sells remanufactured products, but increases when a third-party remanufacturer sells them. We show that an OEM may not always benefit from remanufacturing or preemption and may want to allow third-party competitors to remanufacture its products.

3 - Filtering on the Factory Floor: Shaping Organizational Knowledge at its Root

John Hanson, Assistant Professor, University of San Diego, Alcala West, Durango Suite A, 5998 Alcala Park, San Diego, CA, 92110, United States of America, hansonj@sandiego.edu

Study of Kaizen events shows that process improvements are shaped by what participants choose to bring forward. This filtering is not simply a screen, but a more complex process of connecting data elements that are compatible with the participant's understanding of the precise nature of the problem to be solved. The findings are important because they shed light on how ideas do or don't get into practice and because they show the mechanisms needed for unlearning.

4 - An Example and a Proposal Concerning the Correlation of Worker Processing Times in Parallel Tasks

Kenneth Schultz, Associate Professor, University of Alberta, School of Business Building, Edmonton, Ab, T6G2R6, Canada, klschult@ualberta.ca, Tobias Schoenherr, David Nembhard

We use archival data from a manufacturing line to study sources of variance in processing speeds. We show that workers react to the speed of their coworkers, but that individual reactions vary widely. Since workers are different both in speed and reaction, managerial implications are not straightforward. We model an optimal and an heuristic rearrangement of workers, and suggest a modified heuristic that performs well for increasing throughput.

■ SA64

H-Room 202A, Second Floor

Tutorial: Exploring Best Practices in the Teaching of OR/MS

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Jill Hardin, VCU, 1015 Floyd Ave., P.O. Box 843083, Richmond, VA, 23284-3083, United States of America, jrhardin@vcu.edu

1 - Exploring Best Practices in the Teaching of OR/MS

Jill Hardin, VCU, 1015 Floyd Ave., P.O. Box 843083, Richmond, VA, 23284-3083, United States of America, jrhardin@vcu.edu

This tutorial explores pedagogical techniques in the teaching of operations research and management science. We begin with an overview of best practices presented in the OR/MS literature, and place them in the context of the broader literature on teaching and learning. Discussion and examples of effectively implementing such practices in the OR/MS classroom follow, and various resources will be presented.

■ SA75

C-Room 32A, Upper Level

Student Paper Competition Session

Sponsor: Railroad Applications
Sponsored Session

Chair: Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

1 - Student Paper Contest Submissions

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

This session will feature papers from the RAS Student Paper Contest. The papers will be chosen in August, and Abstracts supplied then. Please keep this session open and in place, as we have had this contest for 5 years without ever having fewer than three papers, but the timing of their submission cannot meet the INFORMS deadlines.

2 - Integrated Service Network Design for Freight Rail Transportation

Endong Zhu, CIRRELT / Université de Montréal, Canada, endong@crt.umontreal.ca, Teodor Crainic, Michel Gendreau

The research aims to produce a good operating plan at the tactical level for freight rail transportation. The service network design problem is studied, as we consider the scheduled service selection, blocking policy, train make-up policy and car distribution together. A 2-layer time-space network is proposed to model the car flow as well as the decisions on both blocks and services. The mixed-integer programming model is difficult and a tabu search heuristic is developed to provide good feasible solutions within reasonable solving effort. Numerical results show the proposed method is robust, and capable to provide near-optimal solutions for rather large instances.

3 - Exact and Heuristic Algorithms for the Curfew Planning Problem
Ashish Nemani, University of Florida, Department of Industrial and Systems, Engineering, Gainesville, FL, 32611, United States of America, aknemani@ufl.edu, Suat Bog

In this paper, we study the Curfew Planning Problem (CPP) encountered by railroads for the maintenance of their railway tracks. The CPP is to design an optimal annual timetable to complete a given set of repairs and replacement jobs (rail-work and tie-work) on the railway tracks for a set of crews specialized in rail-work (rail-crew) or tie-work (tie-crew). We develop the work schedule for each crew such that the disruptions in train routes due to subdivision curfews are minimized. A subdivision is said to be under curfew if any crew is working in it. The solution to the problem must also satisfy several operational and regulatory requirements such as the crew continuity, time windows, the maximum inter-project distance travelled by crews, etc. Our paper presents several solution approaches for the CPP: (i) time-space network model, (ii) duty-generation model, (iii) column-generation model, (iv) decomposition-based heuristics, and (v) optimization-based iterative algorithms. We solve each model using CPLEX and present the computational results based on real-life instances.

4 - SAPI: Statistical Analysis of Propagation of Incidents. A New Approach for Rescheduling
Rodrigo Acuna-Agost, Université d'Avignon et des Pays de Vaucluse, Laboratoire Informatique díAvignon, F-84911, Avignon, France, rodrigo.acuna-agost@univ-avignon.fr, Philippe Michelon, Dominique Feillet, Serigne Gueye

We present a new approach called SAPI (Statistical Analysis of Propagation of Incidents) to repair a disturbed railway timetable after incidents. The method estimates the probability of propagation of incidents to reduce the search space defined by a MIP formulation, obtaining very good solutions in a short time. We tested several versions of this method in two different networks located in France and Chile, showing that our procedure is viable in practice.

Sunday, 11:00am - 12:30am

■ SB01

C-Room 21, Upper Level

Joint Session DA/ENRE: Environmental Decision Analysis

Sponsor: Decision Analysis & Energy, Natural Res & the Environment
Sponsored Session

Chair: Melissa A. Kenney, Postdoctoral Researcher, Environmental Decision Analysis, Johns Hopkins University, 3400 N. Charles St., 313 Ames Hall, Baltimore, MD, 21218, United States of America, m.a.kenneyphd@gmail.com

1 - River Basin Management in Hungary: Stakeholder Decision Making in a Newly Democratizing Nation
Elizabeth Albright, Duke University, 807 Englewood Avenue, Durham, NC, 27701, United States of America, eaa8@duke.edu

The political transition in Central and Eastern Europe (CEE) has been characterized by trends towards democratization and governmental decentralization. During this period of democratic transition, CEE nations that have joined the European Union are increasingly required to include stakeholders in environmental decisionmaking. I examine how stakeholder processes perform in the context of weakened local capacity and newly restructured national and regional environmental management institutions.

2 - Adaptive Environmental Decision Framework
Melissa A. Kenney, Postdoctoral Researcher, Environmental Decision Analysis, Johns Hopkins University, 3400 N. Charles St., 313 Ames Hall, Baltimore, MD, 21218, United States of America, m.a.kenneyphd@gmail.com, Benjamin Hobbs

We present a multistage, multiattribute Bayesian adaptive environmental management framework to address Mississippi River Delta restoration decisions. First we discuss a two-attribute study comparing the scale economies/diseconomies in land building and project cost. Then we present a study, using a subset of objectives, to quantify tradeoffs between learning and action.

3 - The Effect of Environmental Uncertainty on The Tragedy of The Commons
Sam Aflaki, Doctoral Student, INSEAD, Blvd de Constance, Fontainebleau, 77305, France, Sam.AFLAKI@insead.edu

We model a common pool resource game under environmental uncertainty. The existing paradigm regarding increased uncertainty about the sustainable resource size is that it leads to overconsumption. We show that while this is true for increased risk (uncertainty about the states of the environment) independent of the individuals' level of risk aversion, increased ambiguity (uncertainty about the probability of each state) may lead to less consumption when individuals are ambiguity averse.

4 - Uncertainty and Tradeoffs in Urban Water Resources Decision Making: The Case of Phoenix, Arizona
Craig Kirkwood, Professor, Arizona State University, Department of Supply Chain Management, Tempe, AZ, 85287-4706, United States of America, Craig.Kirkwood@asu.edu

Phoenix, Arizona, a rapidly growing large desert city, illustrates the complexity of urban water resources decision making when there is uncertainty about future water supplies and disagreement about tradeoffs among competing objectives. This presentation addresses the impacts of uncertainty and tradeoffs on policy development for urban water resources in this environment, with emphasis on issues associated with global climate change.

■ SB02

C-Room 22, Upper Level

Applications of Problem Structuring Approaches for Decision Modeling

Sponsor: Decision Analysis
Sponsored Session

Chair: Adiel Teixeira Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50.630-970, Brazil, almeidaatd@gmail.com

1 - Using Soft System Methodology to Manage Leakage in Water Supply System
Danielle Morais, Dr, Federal University of. Pernambuco, Recife, PE, Brazil, daniellemorais@yahoo.com.br, Adiel Teixeira Almeida

The leakage problem in water supply is complex and requires co-ordinated actions in different areas of management. Many different alternatives to reduce the problem are known, however the managers do not have a structured process to analyze them. A problem structuring model for improvement of water infrastructure by reducing water losses based on Soft System Methodology is presented. It was useful to facilitate in sharing information and to formalize the integration among the group members.

2 - Increasing Satisfaction of Water Utility Customers by Applying Value-Focused Thinking
Adiel Teixeira Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50.630-970, Brazil, almeidaatd@gmail.com, Danielle Morais

Water supplier companies need to supply water to their customers without supply interruption, with adequate amount, within acceptable quality, with an adequate pressure and at reduced fares. Value-focused thinking approach was used to support decision makers of a Brazilian Water Utility area to understand and modeling their decision problem by considering their values and objectives and also by stimulating to search new decision opportunities.

3 - Achieving Strategic Alignment between IT and Business Using Value-Focused Thinking
Ana Paula Cabral, Dr, Federal University of Pernambuco, Rua Dourtor Pedro Luiz Osrio, 108 JSP, Recife, PE, 50910470, Brazil, apcabral@hotmail.com, Adiel Teixeira Almeida, Danielle Morais

Information Technology (IT) has the function to help the organization to achieve success. Nevertheless, to meet this function, it is essential that IT strategies are aligned with business strategies, establishing a cooperative atmosphere between them. This paper presents a case study in a Brazilian Public Electric Power-Generating Company, using the Value-Focused Thinking to create alternatives through the objectives of the IT managers to attain the strategic alignment between IT and business.

4 - The Plaster Waste Destination Problem in Building Sites: A VFT Application
Luciana Hazin, Federal University of Pernambuco, Rua Manoel Bezerra, 197 Madalena, Recife, Brazil, alencarlh@gmail.com, Caroline Mota, Marcelo Alencar

Since the growing concerned with the environment becomes each time more important,it is each time greater the interest to find solutions that attend the professionals and, at the same time, that decrease the impact in the environment originated by the plaster wasted. In this way, with the aim of identify desirable decision opportunities and create alternatives for the plaster waste problem, the VFT methodology is applied.

■ SB03

C-Room 23A, Upper Level

Game Theory and Computational Economics II

Cluster: Game Theory
Invited Session

Chair: Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu

Co-Chair: Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu

1 - Sufficient Conditions for Computability of Nash Equilibrium in Random Games

Théophane Weber, MIT, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, United States of America, theo_w@mit.edu

Graphical games are a succinct representation of a game which takes place between players who interact with only a few of their neighbors in a network. It is a well-known fact that computing Nash Equilibrium is NP-hard, even when considering sparse networks. We investigate conditions under which the Nash Equilibria of randomized graphical games can be computed efficiently using naturally distributed algorithms.

2 - Social Network Learning with Heterogeneous Preferences

Ilan Lobel, MIT, 77 Mass Ave, Cambridge, MA, United States of America, lobel@mit.edu, Daron Acemoglu, Munther Dahleh, Asu Ozdaglar

We analyze the equilibrium of a model of learning and decision-making over a social network where agents have diverse preferences. Each individual receives some signal about an underlying state, observes the actions of a neighborhood of individuals, and chooses an action. We characterize conditions on the network topology and the utility functions of the agents that lead to efficient aggregation of information.

3 - Dynamic Oligopoly Models for Concentrated Industries

Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu, Bar Ifrach

We study large-scale dynamic oligopoly models that are subject to the "curse of dimensionality". We introduce approximation methods for industries with a few dominant firms and many small firms. This is a relevant and commonly observed market structure in industry data.

4 - Multiple Equilibria in Empirical Pricing Games

Che-Lin Su, The University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, che-lin.su@chicagobooth.edu, Jean-Pierre Dube

Recent demand estimation literature has modelled the data-generation process as an equilibrium outcome from a pricing game between firms facing discrete choice demands. In this talk, we show that many models, such as Bertrand oligopoly with random coefficients logit demand, need not generate a unique price equilibrium. We formulate the estimation problem as a constrained optimization and demonstrate the computational feasibility and efficiency of this approach.

■ SB04

C-Room 23B, Upper Level

Clock Auctions and Related Applications

Cluster: Auctions
Invited Session

Chair: Robert Day, University of Connecticut, OPIM Department, 2100 Hillside Road, Storrs, CT, 06269, United States of America, Bob.Day@business.uconn.edu

1 - Advances in Core-selecting Combinatorial Auctions

Robert Day, University of Connecticut, OPIM Department, 2100 Hillside Road, Storrs, CT, 06269, United States of America, Bob.Day@business.uconn.edu

Auctions in which outcomes are in the core with respect to submitted preferences offer competitive revenues to the seller and arguably fair payments for bidders. This paradigm has recently been adopted for several European spectrum auctions, and is being studied for government applications in the U. S. In this talk I will discuss some of the subtleties of applying this approach in practice, with a focus on algorithmic implementation and the math programming that underlies the process.

2 - A Clock Auction Market for Grid Computing

Sanjukta Smith, Assistant Professor, SUNY Buffalo, 325 Jacobs Management Center, Buffalo, NY, 14260, United States of America, sdsmith4@buffalo.edu, Robert Day, Ravi Bapna, Robert Garfinkel, Jan Stallaert

We develop a customized clock auction that is able to allocate grid resources and discover separate prices for the different computing resources under the condition that buyers do not know with certainty how much of these resources they will need. The proposed clock auction facilitates the discovery of unit prices for the resources in each time period in a finite-horizon market.

3 - Efficiency with Linear Prices? The Combinatorial Clock Auction and its Extensions

Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, martin.bichler@in.tum.de, Pasha Shabalin, Georg Ziegler

We will introduce the CC+ auction, an extension of the CC auction with a modified price update rule, and show that powerset bidding always leads to efficient outcomes. We will also show that with a strong price update rule and a Vickrey payment rule, powerset bidding is an ex-post Nash equilibrium. Computational experiments suggest that the format is robust against restrictions in the number of bids submitted in each round.

■ SB05

C-Room 23C, Upper Level

Panel Discussion: Information and Messages from Editors of QSR Journals

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, University of Iowa, 2138 Seamans Center, Iowa City, United States of America, yongchen@engineering.uiowa.edu

1 - Information and Messages From Editors of QSR Journals

Moderator: Yong Chen, University of Iowa, 2138 Seamans Center, Iowa City, United States of America, yongchen@engineering.uiowa.edu, Panelists: Douglas Montgomery, Jianjun Shi, David Steinberg, Awi Federgruen, Dan Apley, Susan Albin

Editors of several top journals on quality, statistics, and reliability (QSR) areas are invited for this panel discussion. The editors will briefly present the basic information of their journals and their visions on the future directions, including promising topics and how the QSR researchers can contribute to the journals better. A Q&A session and open discussion with the audience will be held following the editors' presentations.

■ SB06

C-Room 24A, Upper Level

Multi-Objective Optimization and Data Mining

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

1 - Dual Multicast in Telecommunication with Shared Risk Resource Group Diverse Constraints

Zhe Liang, Rutgers University, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu, W. Art Chaovalitwongse

We address a multicast problem with Shared Resource Risk Group (SRRG) diverse constraints. An SRRG is a group of resources in a network sharing a common risk. Our problem is to design two multicast trees from two sources with minimum total cost, and guarantee two SRRG-Diverse paths from two sources to every destination. We develop a new tree-based MIP model for the problem and compare it with an edge-based model. Both models provided similar results for the real world test cases.

2 - A Rule Induction Method for Optimizing a Multistage Manufacturing Process with Missing Values

Doh-Soon Kwak, Ph.D Candidate, POSTECH, Industrial and Management Engineering, Pohang, KB, 790-784, Korea, Republic of, dskwak@postech.ac.kr, Kwang-Jae Kim

We propose a method for optimizing a multistage manufacturing process, where a significant portion of the data set has missing values. The proposed method is based on a data mining technique, called Patient Rule Induction Method (PRIM). The performance of the proposed method is demonstrated using a case study on a semiconductor manufacturing process.

3 - Enhanced GRASP with 2-step Local Search for Reconstructing Sibling Relationships Using Genetic Data

Chun-An Chou, Department of Industrial and Systems Engineering, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, joechou@rci.rutgers.edu, Bhaskar DasGupta, W. Art Chaovalitwongse, Tanya Berger-Wolf, Mary Ashley, Isabel Caballero, Saad Sheikh

We propose an enhanced GRASP with a two-step local search for solving the sibling reconstruction problem. A greedy approach with randomized perturbation produces diverse sibling groups. Afterwards a two-step local search is designed particularly to enhance the solution quality of constructed sibling groups by evaluating similarity likelihood. This approach is implemented on real and simulated datasets, respectively, and results show effectiveness compared with other remarkable approaches.

4 - A Probabilistic Framework Utilizing Snapshots Formed From WASM Data

Marc Fridson, Student, Rutgers University, 24 Firethorn Drive, Edison, NJ, 08820, United States of America, mfridson@gmail.com, W. Art Chaovalitwongse, Zhe Liang

A battle space composed of multiple WASMs is an extremely difficult scenario to model, let alone predict. Typically multiple targets are detected at different times. We can assume the entire battle space is scanned in entirety after some predetermined period of time. In this study we attempt to establish some probability framework that can be used to predict future snapshots of a targets position in real time, by analyzing snapshots of time that have already elapsed.

■ SB07

C-Room 24B, Upper Level

Joint Session QSR/MIF: Operational and Logistical Maintenance Decisions

Sponsor: Quality, Statistics and Reliability & Minority Issues Forum
Sponsored Session

Chair: Alaa Elwany, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, United States of America, elwany@gatech.edu

Co-Chair: Nagi Gebraeel, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, nagi@isye.gatech.edu

1 - Value of Monitoring for Replacement under Proportional Hazards with Continuous-time Degradation

Xiang Wu, Iowa State University, Industrial & Mfg Sys Eng., Ames, IA, United States of America, xiangwu@iastate.edu, Sarah Ryan

We investigate the value of perfect monitoring information for optimal replacement of deteriorating systems in the proportional hazards model. To accurately compare costs of policies based on more or less frequent monitoring, we account for transitions among states of the covariate process between observation epochs. Results from a numerical example illustrate monitoring cost relationships under which continuous, discrete, or no monitoring minimizes the overall cost.

2 - Simultaneous Optimization of Maintenance and Production Planning Decisions

Sakine Batun, University of Pittsburgh, Pittsburgh, PA, 15260, sab79@pitt.edu, Lisa Maillart

We consider the problem of determining maintenance and production policies in a multi-product setting under deterioration-state dependent random yield and product mix requirements. We formulate the problem as a MDP and explore the value of simultaneous planning, as opposed to sequential planning, and deterioration state dependent production policies, as opposed to FCFS policies.

3 - Investing for Availability: When to Invest in Redundancy?

Kurtulus Baris Oner, PhD Student, Eindhoven University of Technology, Technische Universiteit Eindhoven, Postbus 513, Eindhoven, 5600 MB, Netherlands, K.B.Oner@tue.nl, Gudrun Kiesmuller, Geert-Jan van Houtum, Alan Scheller-Wolf

We consider a user who buys a number of multi-component systems with a serial structure. For each of the components, she can decide to build in a redundant component. She keeps spare parts on stock and applies repair-by-replacement. Redundancy and spare parts inventory levels are the decision variables. We set our objective as the minimization of the total costs of the systems and analyze the optimal values of the decision variables for varying availability constraints.

4 - Sequential Replacement and Inventory Ordering Policies for Systems with Complex Degradation

Alaa Elwany, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, United States of America, elwany@gatech.edu, Nagi Gebraeel, Lisa Maillart

We propose a framework to sequentially determine optimal replacement and spare parts ordering policies for single-unit systems subject to condition monitoring using dedicated sensors. A random coefficients degradation model is first used to update the evolution of the system's future degradation based on real-time signals. The updated predictive distribution of the future signal is then used to establish structural properties of the optimal replacement policy using Markov decision processes.

■ SB08

C-Room 24C, Upper Level

A Tutorial in Simulation and Surveillance of Infectious Disease

Sponsor: Data Mining
Sponsored Session

Chair: Kwok Tsui, Professor, Georgia Institute of Technology, 765 Ferst Drive, ISyE, Atlanta, GA, 30332, United States of America, ktsui@isye.gatech.edu

1 - A Tutorial in Infectious Disease and Public Health Surveillance

Kwok Tsui, Professor, Georgia Institute of Technology, 765 Ferst Drive, ISyE, Atlanta, GA, 30332, United States of America, ktsui@isye.gatech.edu, Dave Goldsman

Due to various outbreaks of influenza and continuing bioterrorism threat, research efforts on infectious disease and public health surveillance have become very important worldwide. In this tutorial, we will explain and classify the various types of health surveillance problems. We review the latest research in surveillance systems, monitoring methods, and performance measures. We also discuss the research challenges and illustrate them with various problems and examples. In particular, we will compare the performance of Scan, CUSUM, and EWMA charts for temporal, spatial, and spatiotemporal surveillance.

2 - A Tutorial in Simulation Modeling of Influenza Pandemic

Dave Goldsman, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, sman@isye.gatech.edu, Kwok Tsui

Due to various outbreaks of influenza and continuing bioterrorism threat, research efforts on infectious disease simulation and its impact in public health have become very important worldwide. In this tutorial, we will discuss basic SIR simulation models for influenza pandemic transmission. In particular, we will discuss generic simulation models that can be customized to specific population distributions, including age, household size and household composition distributions. We will also investigate the impact of various medical and non-medical intervention strategies under our models.

■ SB09

C-Room 25A, Upper Level

Many-server Heavy-traffic Approximations

Sponsor: Applied Probability
Sponsored Session

Chair: Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu

1 - "c mu / theta" Rule for General Service Time and Exponential Abandonments

Gennady Shaikhet, Postdoc, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, shaikhet@cmu.edu, Kavita Ramanan

Consider an overloaded queueing network with several customer classes and one service pool. For class i customers we have generally distributed service time with rate mu_i and exponential abandonments with rate theta_i. Let also c_i be a holding cost per unit time for class i. We introduce "c mu / theta" type policy that asymptotically minimizes overall long run average holding cost.

2 - Two-Parameter Heavy-Traffic Limits for Infinite-Server Queues with Delayed Feedbacks

Guodong Pang, Columbia University, IEOR Department, New York, NY, 10027, United States of America, gp2224@columbia.edu, Ward Whitt

We prove FWLLN and FCLT limits for queue-length processes, including remaining service times, for non-Markovian infinite-server queues with delayed feedback, where both the arrivals and the feedback are allowed to be time varying. We are motivated by call centers in which customers may not initially receive adequate service, and so often need to call back later, which adds to the system load and changes time-varying arrival patterns.

3 - Heavy-Traffic Limits Via an Averaging Principle; Convergence and Stability Analysis

Ohad Perry, Columbia University, New York, NY, United States of America, op2105@columbia.edu, Ward Whitt

We consider a parallel-server system with two customer classes and two server pools operating under a Fixed-Queue-Ratio with Thresholds (FQR-T) routing rule. We prove a functional law of large numbers via an averaging principle and analyze properties of the limit, such as stability and interchange of limits. Building on the fluid limit we establish convergence to diffusion limits via state-space collapse.

4 - Some Piecewise Linear SDE's Driven by Levy Processes

Josh Reed, Leonard N. Stern School of Business, New York University, New York, NY, jreed@stern.nyu.edu, Bert Zwart

We investigate a class of Levy-driven SDE's arising as the limits of multi-servers queues with heavy-tailed interarrival times and with service interruptions. We study the case of spectrally negative Levy processes and obtain expression for the Laplace transforms of the stationary distribution. Next, we study the time dependent distributions and the case in which the Levy process may have jumps in both directions.

■ SB10

C-Room 25B, Upper Level

Computational Methods in Revenue Management and Economics

Sponsor: Applied Probability
Sponsored Session

Chair: Sunil Kumar, Stanford University, Graduate School of Business, Stanford, CA, 94305-5015, United States of America, Kumar_Sunil@gsb.stanford.edu

1 - Repeated Resolves Policy for Network Revenue Management

Stefanus Jasin, Stanford University, 1030 El Monte Ave # 215, Mountain View, CA, 94040, United States of America, stf48198@stanford.edu, Sunil Kumar

Many popular heuristics for Network RM involve repeatedly resolving deterministic Linear Program (RDLP). We study an RDLP heuristic in a model where demand arrives according to Poisson processes. We give a performance guarantee that depends on the choice of re-solving times and show that with frequent re-solving the regret of this heuristic does not scale with the size of the problem. It is also possible to incorporate learning of parameters and still maintain excellent performance.

2 - Dynamic Pricing to Learn and Earn: Promise and Pitfalls of Myopic Bayesian Policies

N. Bora Keskin, PhD Student, Stanford University, 121 Campus Dr, Apt 3403A, Stanford, CA, 94305, United States of America, bkeskin@stanford.edu, Assaf Zeevi, J. Michael Harrison

Motivated by applications in financial services, we consider a seller who offers prices sequentially to a stream of potential customers, observing either success or failure in each sales attempt. The parameters of the underlying demand model are initially unknown, so each price decision involves a trade-off between learning and earning. We analyze the performance of a myopic Bayesian policy (MBP), and propose ways of tweaking the MBP to guard against poor performance.

3 - Asymptotic Analysis of Large Scale Dynamic Stochastic Games

Ramesh Johari, Stanford University, Terman Engineering Center, Stanford, CA, 94305, United States of America, rjohari@gmail.com, Sachin Adlakha, Gabriel Weintraub, Andrea Goldsmith

We study stochastic games with a large number of players who are coupled via their payoff functions. We study "oblivious equilibrium"ù (OE), where each player reacts only to the average behavior of other players. We characterize a set of conditions on model primitives under which OE approximates Markov perfect equilibrium.

■ SB11

C-Room 25C, Upper Level

Homeland Security Applications

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Rajan Batta, Professor, University at Buffalo (SUNY), Department of Industrial & Systems Engineering, 410 Bell Hall, Buffalo, NY, 14260, United States of America, batta@eng.buffalo.edu

1 - Assessing the Impact of Alternate Objectives on the Spatial Properties of Solutions in CIKR Defense

Justin Yates, Assistant Professor, Texas A&M University, 237D Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States of America, jtyates@tamu.edu, Sujeev Sanjeevi

Years of focus on the problem of protecting critical infrastructure and key resources (CIKR) has led to the development of a plethora of models for optimizing the allocation and usage of defense resources in such tasking. This presentation examines how differences in modeling these problems affect the spatial distribution/utilization of resources within an area-of-interest and discusses how spatial properties may be exploited in the development of new solution techniques.

2 - Navy Officer Manpower Optimization Incorporating Budgetary Constraints

Javier Salmeron, Associate Professor, Naval Postgraduate School, 1411 Cunninham Rd., Monterey, CA, 93943, United States of America, jsalmero@nps.edu, David Clark

This work develops the Requirements-Driven Cost-Based Manpower Optimization (RCMOP) model to guide monthly values for officer inventory, promotions, accessions, designator transfers, and forced and natural losses. RCMOP minimizes unmet manpower requirements while meeting the Navy's fiscal constraints. Resulting costs fall within 10% of budget estimates, and promotion metrics approximate the values expected by law and policy. The model indicates a need to increase OCS accessions by 11%.

3 - Software Assistants for Real Patrol Planning

Fernando Ordonez, Associate Professor, Daniel J. Epstein Department of Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089-0193, United States of America, fordon@usc.edu, Milind Tambe

Limited security resources prevent 24/7 coverage of locations of interest, allowing adversaries to exploit patterns in patrolling. Effective patrols therefore should also be unpredictable. We use Stackelberg game models to obtain effective random patrols. This has lead to the development of software assistants that are currently used in planning real patrols. Here we describe the overall process of developing these applications.

4 - A Mathematical Model for Immobile Entity Search on a Network

Wanyan Yu, University at Buffalo, Buffalo, United States of America, wanyanyu@buffalo.edu, Rajan Batta

We consider the problem of searching for a single, uniformly distributed immobile entity on an undirected network. The objective is to minimize the expected search time to find the entity. We formulate it as a MIQCP (mixed integer quadratic constrained problem) and solve it using CPLEX for a small-size network. Then we revise the model as a mixed integer problem and introduce a heuristic algorithm integrated with the CPLEX solver to provide a better solution for a larger network.

■ SB12

C-Room 26A, Upper Level

Urban Planning

Contributed Session

Chair: Takamori Ukai, Nanzan University, 27 Seirei-cho, Seto, Japan, ukai@nanzan-u.ac.jp

1 - Providing Services to the World: Optimizing with Respect to Multiple Concentric Zones of Population

Baris Hasdemir, UMASS Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, hasdemir@som.umass.edu, Agha Iqbal Ali

Improved access to centers that provide a service or commodity is relevant in both the public and private sectors. A center provides better access if it is located so as to serve maximal populations within successive concentric rings. This paper presents a location model that seeks to maximize served populations within multiple concentric rings. The model is applied to a variety of scenarios in different geographical regions using data for populated places in the USA, Europe, India and Africa.

2 - Optimal Location of Facilities with Limited Capacity
Takamori Ukai, Nanzan University, 27 Seirei-cho, Seto, Japan, ukai@nanzan-u.ac.jp

At the facility which has limited capacity, users can not always be provided service, but be passed around. In the situation that the total number of servers is constant, more facilities reduce servers of individual facility. Therefore though the distance from users to facility decreases, the loss probability increases. We consider the number of facilities and their location which minimizes total distance, taking account of the loss probability which depends on their capacity and demands.

■ SB13

C-Room 26B, Upper Level

Algorithms and Tools for Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu

1 - Signal Reconstruction Algorithms on Graphical Processing Units
Sangkyun Lee, University of Wisconsin-Madison, Computer Sciences, Madison, United States of America, sklee@cs.wisc.edu, Stephen Wright

Several highly effective algorithms for compressed sensing and image reconstruction applications can be efficiently implemented on modern graphical processing units (GPUs). The properties of the algorithms and applications are discussed, and computational results are presented to show large speedups over CPU implementations.

2 - A Large-scale Affine Variational Inequality Solver Based on a Path-following Method
Qian Li, University of Wisconsin-Madison, Department of Mathematics, 480 Lincoln Dr, Madison, 53706, United States of America, qli@math.wisc.edu, Michael Ferris

PathAVI is an implementation of a path-following method for solving affine variational inequalities (AVIs). It exploits the special structure of the underlying polyhedral set and employs a pivotal scheme to solve a class of models (formulated as AVIs), whose equivalent linear complementarity reformulations cannot be processed by existing complementarity solvers. PathAVI is capable of processing large-scale AVIs by incorporating sparse linear system packages and updating schemes.

3 - GDXMRW: Exchanging Data between GAMS and Matlab
Steven Dirkse, Director of Optimization, GAMS Development Corporation, 1217 Potomac Street NW, Washington, DC, 20007, sdirkse@gams.com, Michael Ferris

We discuss GDXMRW (GDX-Matlab Read/Write), a tool for moving data between GAMS and Matlab. This data exchange gives MATLAB users the ability to use all the optimization capabilities of GAMS, and allows visualization of GAMS data directly within MATLAB. The tool is based on GDX (GAMS Data eXchange), a well-established and public API for exchanging data with GAMS.

4 - Facebook Friend Wheels and Quadratic Assignment
Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu, Cody Bredendick

A friend wheel is an image used on Facebook to provide a visual representation of the relationships between the friends any one person may have. We outline a tool, based on the solution of quadratic assignment problems, that generates such a wheel. The tool uses the Facebook API to gather data, the GRASP heuristic to solve the model, and GraphViz to generate the visualization.

■ SB14

C-Room 27A, Upper Level

Computational Issues in Stochastic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

1 - Approximation Algorithms for Stochastic Combinatorial Optimization with Risk
Evdokia Nikolova, MIT, Cambridge, MA, United States of America, enikolova@csail.mit.edu

We provide general-purpose fully-polynomial approximation algorithms for a framework of stochastic optimization that incorporates risk. The stochasticity is specified via arbitrary independent distributions. We assume access to a solver for the underlying deterministic problem, which may be exact or approximate. Our algorithms are based on a new methodology for approximating low-rank nonconvex optimization.

2 - Parallel Generation and Solution of Stochastic Programs Using COIN-OR Utilities
Alan King, IBM Research, P.O. Box 218, Yorktown Heights, United States of America, kingaj@us.ibm.com, Sheng Yuan Chen

To solve truly large stochastic programs requires parallelization not only of the solver but also of the generation and report-writing phases. The COIN-OR packages FlopC++ and SMI have been adapted to generate stochastic programming data from a modeling language. Furthermore there exists a new interior point decomposition solver for SMI. In this talk we show how the packages can be combined for the parallel generation, solution, and report-writing for stochastic programs.

3 - Amsaa: A Multistep Anticipatory Algorithm for Online Stochastic Combinatorial Optimization
Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

This talk proposes Amsaa, an anytime multi-step anticipatory algorithm for online stochastic optimization. Amsaa uses the sampling average approximation method to approximate the problem which is then solved using a search algorithm for MDPs. Amsaa was evaluated on a stochastic project scheduling application and it outperforms state-of-the art algorithms.

4 - Scalable Heuristics for Stochastic Programming with Scenario Selection
Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States of America, jpwatson@sandia.gov, Roger Wets, David Woodruff

We describe computational procedures to solve a wide-ranging class of stochastic programs with chance constraints where the random components of the problem are discretely distributed. Our procedures are based on a combination of Lagrangian relaxation and scenario decomposition, solved using a novel variant of progressive hedging. Experiments demonstrate the ability of the algorithm to quickly find near-optimal solutions to difficult and large chance constrained stochastic programs.

■ SB15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - AMPL Optimization LLC - Attacking Hard Mixed-Integer Optimization Problems through the AMPL Modeling Language
Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu, David M. Gay

There are many tricks for formulating complex optimization models by use of integer variables, but what's to be done when even the most advanced solvers can't produce results in reasonable time? A series of examples show how substantial improvements in performance can be achieved through carefully focused troubleshooting and experimentation facilitated by the power and flexibility of the AMPL modeling language and its solver interfaces.

2 - GAMS Development Corporation - Rapid Application Prototyping with GAMS
Lutz Westermann, GAMS Development Corp., 11217 Potomac Street, NW., Washington, DC, 20007, United States of America, lwestermann@ gams.com

GAMS Development will demonstrate how an application can be built using GAMS. We'll use both fundamental modeling practices, our state-of-the-art solvers and the latest in data access and application integration tools to quickly produce a working application.

■ SB16

C-Room 28A, Upper Level

Monetizing Online Social Networks

Sponsor: Information Systems
Sponsored Session

Chair: Param Singh, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, United States of America, psidhu@cmu.edu

1 - How Valuable are Online Social Networks? Evidence From Online P2P Lending Markets

Siva Viswanathan, Associate Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Mingfeng Lin, Nagpurnanand Prabhala

This study examines the role of social networks in mitigating information asymmetry in a decentralized online marketplace. Using a comprehensive dataset from an online peer-to-peer lending marketplace, we find that the relational aspects of networks create value for the marketplace by exerting peer pressure and increasing the verifiability of ties.

2 - Economics of User-Generated Content: Text Mining, Image Classification and Demand for Hotels

Anindya Ghose, Assistant Professor, NYU Stern, 44 West 4th Street, New York, United States of America, aghose@stern.nyu.edu, Beibei Li, Panos Ipeirotis

Using structural modeling techniques, we estimate demand for hotels as a function of their internal (service) and external (locational) characteristics. We have a unique dataset of hotel reservations from Travelocity. Further, we have data from: (i) textmining of reviews on Travelocity and Tripadvisor, (ii) social tags identifying different locational attributes of hotels, (iii) user-contributed opinions on hotel characteristics from Amazon Mechanical Turk, and (iv) satellite images of the area.

3 - Consumer Choice in an Online Community: Impact of Social Influence on Music Consumption

Jui Ramaprasad, University of California-Irvine, Paul Merage School of Business, Irvine, CA, 92697, jui.ramaprasad@mcgill.ca, Sanjeev Dewan

We examine the impact of online social influence on consumption, in the illustrative context of an online music community. We look at social influence through aggregate "bandwagon" influence and local network influence. Exploiting a unique natural experiment, we find that the ability to observe aggregate peer decisions impacts individual choices (the bandwagon effect). We also find that adoption decisions of local network neighbors significantly influence a focal actor's choices.

4 - Size Doesn't Matter: Network Externalities Vs. Information Cascades

Eric Walden, Texas Tech University, 19th Street, Lubbock, TX, 79409, United States of America, ewalden@andrew.cmu.edu, Jaeki Song

In this paper we compare network externality theory and information cascade theory as predictors of adoption. Making use of experimental economics we design a laboratory experiment where individuals receive cues consistent with both network externality theory and information cascade theory. We find that the network externality cues have no effect on the willingness to adopt, while the information cascade cues have strong impacts on the willingness to adopt.

■ SB17

C-Room 28B, Upper Level

Panel Discussion: NeuroIS: What are the Opportunities and Challenges of Using Decision Neuroscience in Information Systems

Sponsor: Information Systems
Sponsored Session

Chair: Angelika Dimoka, Assistant Professor - Director, Center for Neural Decision Making, Temple University, 510 Alter Hall, 1801 Liacouras Walk, Philadelphia, PA, 19122, United States of America, angelika@temple.edu

1 - NeuroIS: What are the Opportunities and Challenges of Using Brain Imaging in Information Systems?

Moderator: Paul Pavlou, Associate Professor of Information Systems, Marketing, and Management, Temple University, 1810 N. 13th St., Philadelphia, PA, United States of America, pavlou@temple.edu, Panelists: Izak Benbasat, Richard Bagozzi, Alok Gupta

Cognitive neuroscientist have been examining the functionality of brain areas that underlie higher-order human functions and processes using functional neuroimaging tools to derive interesting insights by opening the "black box" of the brain. This talk discusses the opportunities and challenges of applying cognitive neuroscience theories and methods to inform IS research (termed "NeuroIS") to supplement, complement, and even challenge existing IS theories, methods, and data.

■ SB18

C-Room 28C, Upper Level

Stochastic Optimization in Energy

Sponsor: Computing Society
Sponsored Session

Chair: Robert Entriken, Senior Manager, EPRI, 3420 Hillview Avenue, Palo Alto, CA, 94306, United States of America, rentrike@epri.com

1 - Optimal Control and Valuation of Wind Energy Storage under Advance Commitments

Jae Ho Kim, Princeton University, Princeton, NJ 08544 jaek@Princeton.EDU, Warren Powell

We solve the problem of making advance energy commitments for wind farms in the presence of a storage device with conversion losses. We derive the optimal policy for making advance commitments for the case in which the forecast of electricity generated from the wind farm is uniformly distributed. The stationary distribution of the storage level corresponding to the optimal policy is obtained, from which the economic value of the storage is computed.

2 - SMART: Stochastic, Multiscale Energy Policy Model

Warren Powell, Professor, Princeton University, Sherrerd Hall 230, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Abraham George, Alan Lamont, Jeffrey Stewart

SMART is a model that plans over a dozen types of energy investments over a multidecade horizon, while also modeling hourly variations in wind, solar and energy demands. It can handle uncertainty in wind, demand and prices, seasonal variations in rainfall, and uncertainty in technology, policy and climate. Approximate dynamic programming is used to make storage decisions on an hourly level, and investment decisions on a yearly level. We report on experimental tests validating the ADP algorithm.

3 - A Stochastic Optimization Model for Robust Power Network Design

Nikita Boyko, PhD Student, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, nikita@ufl.edu, Panos Pardalos, Stan Uryasev, Vladimir Boginski

We propose a stochastic formulation of minimum cost flow problem aimed at finding network design and flow assignments subject to uncertain factors, such as network component disruptions/failures. In order to quantify the uncertain loss caused by network failures we utilize CVaR risk measure.

4 - Reserve Determination with Stochastic Optimal Power Flow

Robert Entriken, Senior Manager, EPRI, 3420 Hillview Avenue, Palo Alto, CA, 94306, United States of America, rentrike@epri.com, Taiyou Yong, Pei Zhang

This paper presents a methodology to determine the energy and reserve schedules with consideration of power system uncertainties using a reserve requirement that is generated to meet both the system reliability and economic efficiency under system uncertainties. This study emphasizes the impact of the intermittent generation on the energy schedule and reserve determination, and so provides a new methodology for addressing emerging system issues with the emergence of renewable energy.

■ SB19

C-Room 28D, Upper Level

Network Signal Optimization

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Lihui Zhang, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, zhanglh0@ufl.edu

1 - A Corridor Signal Optimization Model Based on the Enhanced Cell Transmission Model

Zichuan Li, University of Maryland, College Park, Dept of Civil & Environmental Engineerin, 1173 Glenn L. Martin Hall, College Park, MD, 20705, United States of America, lizichuan@gmail.com, Gang-Len Chang

This study presents a signal optimization model based on the enhanced cell transmission model. Some new features are proposed to the original Cell Transmission Model (CTM) model. Based on the proposed model, a signal optimization model is formulated. A Genetic Algorithm based solution method is proposed and a real site case study with light, moderate, and congestion traffic demands are provided with performance comparison using a third part simulation package, CORSIM.

2 - Domain Partitioned Hierarchical Network Traffic Management Concept and Methodology

Ying-Ying Ma, Tongji University, 4800 Cao'an Road, Department of Traffic Engineering, Shanghai, 201804, China, yingyma@email.arizona.edu, Xiao-Guang Yang, Yi-Chang Chiu

Urban network traffic management is a complex real-time system, especially signal control and route guidance. It is hard to get a global optimal solution in real-time in these systems. In this talk, we decompose the traffic network into sub-networks in a hierarchical structure to simplify the system and improve the reliability and flexibility of the management. Spectral method was used in domain partitioning and tested on a case study in a network of Guangzhou in China.

3 - A Simplified Shockwave-based Arterial Traffic-flow Model for Congested Signalized Networks

Xinkai Wu, PhD Candidate, Department of Civil Engineering, University of Minnesota, 500 Pillsbury Drive S.E., Minneapolis, MN, 55455, United States of America, wuxxx273@umn.edu, Henry Liu

We present a shockwave-based arterial traffic-flow model (SWAT). Unlike conventional models which discretize space into small intervals, SWAT treats links as sections, with traffic states simplified into free-flow, saturated, and jammed conditions. Traffic dynamics are analytically described by integrating flow conservation over a shockwave profile. SWAT significantly improves numerical efficiency, making it appropriate for large-network signal optimization and traffic assignment problems.

4 - Robust Signal Timing for Arterials under Day-to-Day Demand Variations

Lihui Zhang, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, zhanglh0@ufl.edu, Yingyan Lou, Yafeng Yin

This paper formulates a scenario-based stochastic programming model to optimize the timing of pre-timed signals along arterials with day-to-day demand variations. Based on a cell-transmission representation of traffic dynamics, cycle length, green splits and offsets are determined to minimize the expected delay incurred by high-consequence demand scenarios. A simulation-based genetic algorithm is proposed to solve the model. A numerical example is presented to verify and validate the model.

■ SB20

C-Room 28E, Upper Level

Heuristics for Vehicle Routing Problems II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Frederic Semet, Professor, LAGIS, Ecole Centrale de Lille, Cité Scientifique - BP 48, Villeneuve d'Ascq, 59651, France, frederic.semet@ec-lille.fr

1 - Vehicle, Location, and Inventory Routing for Disaster Relief

Russell Bent, Scientist, Los Alamos National Laboratory, Mail Stop K488, P.O. Box 1663, Los Alamos, NM 87545, Los Alamos, NM, 87545, United States of America, rbent@lanl.gov, Pascal Van Hentenryck, Carleton Coffrin

Recent natural disasters such as the Indonesian tsunami and Hurricane Katrina have demonstrated a need for better disaster preparedness and response. We develop a new constraint-based local search that tightly integrates preparedness (supply pre-positioning) with distribution (routing). We demonstrate its effectiveness on location and inventory routing benchmarks with several improvements on the existing upper bounds. We apply the approach to the problem of potable water distribution.

2 - Routing Trucks in a Multi-Depot Snow Emergency Network: Formulation and Heuristic

Ali Haghani, Professor and Chairman, Department of Civil & Environmental Engineering, 1173 G Glenn Martin Hall, University of Maryland, College Park, MD, 20742, United States of America, haghani@umd.edu, Shahab Toobaie, Masoud Hamedi

This paper proposes a mathematical model and a Genetic Algorithm solution to multi-depot multiple-size truck snow routing problem. The objective is to minimize the number of trucks and deadhead miles subject to truck capacity, workload balancing and route continuity constraints. Numerical results of a real world problem are presented.

3 - The Multi-Period Multi-Zone Vehicle Routing Problem with Time Windows

Michel Gendreau, Professor, CIRRELT/Université de Montréal, C.P. 6128, succ. Centre-ville, Montréal, QC, H3C 3J7, Canada, michel.gendreau@cirrelt.ca, Teodor Crainic, Yuvraj Gajpal

We introduce a new variant of the Vehicle Routing Problem in which customers are divided into a number of zones. The customers of each zone must be served within tight time windows by dedicated routes originating at a specified zone depot. A key feature of the problem is that a vehicle can be used to cover routes in different zones at different times. The main objective is to minimize the overall number of vehicles required to serve all customers. Heuristics and bounds will also be presented.

4 - Hybrid Heuristics for the Capacitated Location-Routing Problem

Frederic Semet, Professor, LAGIS, Ecole Centrale de Lille, Cité Scientifique - BP 48, Villeneuve d'Ascq, 59651, France, frederic.semet@ec-lille.fr, Celia Boulanger

The capacitated location-routing problem (CLRP) consists of determining locations for depots from which customers are served on routes with the objective of minimizing the overall cost. In the CLRP capacity restrictions for the depots and the vehicles are imposed. We propose hybrid heuristics in which location problems and routing problems are solved repeatedly. Computational results show that the most efficient approaches compete favorably with the best heuristic previously described.

■ SB21

C-Room 30B, Upper Level

Air Traffic Management 2

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, Department of Civil Engrg., 1173 Martin Hall, College Park, MD, 20742, United States of America, lovell@umd.edu

1 - A Dynamic Stochastic Model for the Air Traffic Flow Management Problem

Yudong Chen, University of Texas at Austin, 1 University Station, C0806, Austin, TX, 78712, United States of America, ydchen@mail.utexas.edu

We describe a dynamic stochastic integer program for the general Air Traffic Flow Management problem. In our model, arrival capacities, departure capacities and air sector capacities are subject to uncertainty, and ground and airborne holding decisions are made sequentially based on updated information. We also develop computational techniques which enable us to solve large scale instances with several thousand flights, demonstrating feasibility to practical problems.

2 - Comparison of Strategies for Collaborative Rerouting in the Airspace Flow Program

Amy Kim, Student, UC Berkeley, 109 McLaughlin Hall, Berkeley, CA, 94720, United States of America, amy_kim@berkeley.edu, Mark Hansen

The Airspace Flow Program addresses demand/capacity imbalances due to constraints in en route airspace. The program is currently set up such that the FAA controls delayed departure times but does not initially control rerouting. As demands increase, it will be beneficial to centralize rerouting allocations to maximize use of available capacity. This research attempts to the most effective methods of minimizing user costs in an AFP initiative that employs both rerouting and ground delays.

3 - Stochastic National Airspace System (NAS) Flow Analysis Model
Nastaran Coleman, Sr. Operations Research Analyst, Federal Aviation Administration, 800 Independence Ave, SW, Washington, DC, 20591, United States of America, nastaran.coleman@faa.gov

Combining Monte Carlo simulation and linear programming, modeled NAS including all its airports, fixes and routes as a network. Determined average NAS capacity. This model can be used to evaluate potential benefits or disadvantages of various natural and artificial interventions more accurately compared to the previous deterministic model. Examples include reducing en-route separation standards, increasing airport capacities, smoothing traffic, and disruptive weather phenomena

4 - Modeling the Impact of Super Heavy Transport on Surface Movement
Shin-Lai Tien, Graduate Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, alextien@umd.edu, David Lovell

Aircraft like A380 super heavy transports (SHT) are expected to increase complexity in airport surface operations and induce additional taxiing delay to flights operating in their time proximity. Statistical analyses confirm the impact of A380 operations on taxiing activities at U.S. airports. To simulate the next generation air traffic control environment, several cases where an SHT could potentially influence other surface movements are identified and their modeling approaches are proposed.

■ SB22

C-Room 30C, Upper Level

Public Transit II: Equity, Availability and Assignment

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Nicholas Lownes, Assistant Proessor, University of Connecticut, 261 Glenbrook Rd, Unit 2037, Storrs, CT, 06268, United States of America, nlownes@engr.uconn.edu

1 - Incorporating Environmental Justice & Equity Metrics in Transit Network Design
Erin Ferguson, Graduate Researcher, University of Texas at Austin, Department of Civil, Arch., & Env. Engin., 1 University Station C1761, Austin, TX, 78712, United States of America, ferguson.em@gmail.com, Jennifer Duthie, Avinash Unnikrishnan, Travis Waller

The focus of this work is to develop a mathematical programming formulation, which incorporates equity and environmental justice metrics into the transit network design problem. The formulation will be able to accommodate several different optimization goals addressing equity issues such as access to services based on distance and travel time and access to multiple service options. Heuristics will be developed to solve the problem and the performance will be compared on realistic test networks.

2 - Integrated Control Strategies of Vehicle Holding and Boarding Limits with Real Time Information
Felipe Delgado, Pontificia Universidad Catolica de Chile, Vicuña Mackenna 4860, Macul, Casilla 306, Santiago, Chile, fadelgab@ing.puc.cl, Aldo Cipriano, Ricardo Giesen, Juan Carlos Muñoz

This work discuss the conditions under which limiting the maximum number of passengers to board a bus can be more beneficial by extending a real time mathematical programming model of buses, developed by Delgado et al (2009), to allow for only holding strategy. The results show that, in scenarios of high passenger demand and short bus headway operations, strategies that combine holding and boarding limits perform significantly better than just holding.

3 - The Social Accessibility of Transit Network Design
Nicholas Lownes, Assistant Proessor, University of Connecticut, 261 Glenbrook Rd, Unit 2037, Storrs, CT, 06268, United States of America, nlownes@engr.uconn.edu

The social impacts of transit network design go beyond providing service to captive users. Transit systems influence the way people interact, the choices they make regarding employment and residence location and how they view their community. This paper takes a look at several social accessibility metrics in the context of transit network design and contrasts their results with the traditional network design paradigms focusing on operator costs and travel time.

4 - Emergency Transportation for Low-Mobility Groups
Mark Hickman, University of Arizona, Tucson, AZ, mhickman@email.arizona.edu, Chi Pak Chan

During emergencies, low-mobility groups face greater risk and exposure. It is important to consider their needs in assigning vehicles to pick them up and transport them to safe locations. This is formulated as a combination of a static location problem and a dynamic vehicle routing problem. We present these models and illustrate how they might be used to support decisions in providing emergency mobility.

■ SB23

C-Room 30D, Upper Level

Business Mission Area - Process Improvement

Sponsor: Military Applications Society
Sponsored Session

Chair: Tim Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, 422 Mahan Hall, West Point, NY, 10996, United States of America, timothy.elkins@usma.edu

1 - Data Quality Management for the U.S. Army
Doug Matty, LTC, MIT / US Army, dmatty@mit.edu, Richard Wang

Principles to achieve business transformation are grounded on the integration of business processes and process replication. This requires data quality. This paper presents management principles as part of the MIT Information Quality Program. The principles include identification of stakeholder roles, data quality metrics and a maturity assessment framework. These data quality approaches provide the necessary data for enterprise analytics to enable transformation efforts.

2 - End-to-End Business Processes as a Measure for Cost and Performance
Thomas Lennox, Business Transformation Agency, Department of Defense, 1851 South Bell St., Alexandria, VA, thomas.lennox@bta.mil

In today's DOD stove pipe world where we develop multiple function specific ERP's, the use of these processes as an analysis tool identifies gaps in implementation strategies and the potentiall significant costs incurred as a result of creating interfaces to close the gaps in the process. Using these processes in the analysis of ERP implementations, measurable probabilities of successful system implementation both from a sustainment cost and performance standpoint are obtained.

3 - Lean Six Sigma Methodology Being Taught to Cadets at the United States Military Academy
Donna Korycinski, Asst. Professor / EM Program Dir., USMA, Bldg 752, Dept of Sys Eng, West Point, NY, 10996, United States of America, donna.korycinski@usma.edu

In 2005, the U.S. Army mandated the implementation of Lean Six Sigma to realize process efficiency and to reap monetary savings. This methodology is taught to interested cadets in the Department of Systems Engineering at the United States Military Academy during the year-long capstone experience; the cadets receive U.S. Army Green Belt certification upon project completion. Teams of cadets have assisted the Deployed Warrior Medical Management Center in Landstuhl, Germany for the past two years.

4 - Injection of RAM Modeling & Assessment into Armored Combat System Optimization Modeler (ACSOM)
Steve Rapp, General Dynamics Land Systems, 38500 Mound Road, Sterling Heights, MI, 48310, United States of America, rapps@gdls.com, Greg Hartman, Ratna Babu Chinnam, Alper Murat

ACSOM mathematically optimizes system models using multi-criteria mathematical optimization. Prior to this study subsystem reliability estimates were used in a series structure assuming constant hazard rate and mature technology. However, RAM is inherently non-linear and needs to be assessed with Growth Potential and Lifecycle Cost. In this study, we improved ACSOM's RAM modeling by injecting DFR earlier into the PD cycle.

■ SB24

C-Room 30E, Upper Level

Manpower Modeling I

Sponsor: Military Applications Society
Sponsored Session

Chair: Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington, VA, 22207, United States of America, marie.hall@us.army.mil

1 - System Dynamics Modeling of Army Officer Lifecycle Management
Daniel McCarthy, Lieutenant Colonel, US Army, Director, Systems Engineering and Operations Research Program, United States Military Academy, Dept of Systems Engineering, Department of Systems Engineering, Mahan Hall, Rm 419, West Point, NY, 10996, United States of America, Daniel.McCarthy@usma.edu

With the transition of the Army to the Brigade Combat Team (BCT) concept, the requirement for Captains and Majors grew significantly. The Army has made changes to the officer accession program and the officer retention program in an effort to close this gap. This research effort uses a System Dynamics approach to model the life cycle of an officer's career at the individual and aggregate level in order to better understand the short and long term impact of these changes.

2 - Personnel Friction in the Army Manning System

Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington VA 22207, United States of America, marie.hall@us.army.mil, Jake LaPorte

If the Army has more people than it has spaces, how can units in the field be experiencing shortages at particular grades and specialties? Friction is defined as the misalignment of personnel inventory to the authorized force structure by grade, specialty and location. The purpose of this study is to measure the historical friction levels in order to determine the factors that affect these levels and produce a model that will predict friction subject to certain policy decisions.

3 - Modeling the Army Officer Manpower Program in an Evolving Environment

Andrew Hall, Assistant Professor, United States Military Academy, Department of Mathematical Sciences, 4760 N 40th Street, Arlington VA 22207, United States of America, andrew.o.hall@us.army.mil, Kerry Moores, Dan Shrimpton

Officer strength forecasts are critical to the Army for programming resources, predicting readiness, and analyzing policy. The officer manpower model factors in historical accessions, attrition, promotions, as well as laws and policies that impact officer strength. This research details the changing composition of the officer corps, model adaptations and impact on analysis in order to most accurately forecast officer strength.

4 - Retention Modeling Mechanisms to Prescribe Optimal Retention Targets by Skill, Grade and Expiration

Jay April, Chief Development Officer, OptTek Systems, Inc., 1919 Seventh Street, Boulder CO 80302, United States of America, april@opttek.com, Jose Ramirez

The Army's Personnel Inventory Program is currently developed by projecting losses based on historic retention behavior and optimally scheduling accessions and promotions. This approach largely assumes Retention behavior is a constraint. However, due to the state of the nation's economy, the Army has experienced lower than expected Losses . Here we develop a formulation that determines optimal retention targets by skill, grade and ETS Cohort.

■ SB25

C-Room 31A, Upper Level

Advances in Material Handling and Storage Systems

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Kevin Gue, Associate Professor, Auburn University, Department of Industrial and Systems Eng, Auburn, AL, 36849, United States of America, kevin.gue@auburn.edu

1 - Shared Storage Assignment Policy in a Compact Storage System

Nima Zaerpour, PhD Candidate, T10-46- RSM Erasmus University, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, NZaerpour@rsm.nl, Rene De Koster, Yugang Yu

This paper studies how to store pallets in a compact storage system in order to minimize the makespan for retrieving pallets. The system stores pallets multi deep. In practice, dedicated storage is used; every storage lane in the system stores only one product type to avoid reshuffling. This paper proposes a mathematical model considering a shared storage policy. The policy allows different product types to share the same lanes. A heuristic algorithm is proposed to solve large-scale problems.

2 - Decentralized Control for Material Handling Systems

Kai Furmans, Kai.Furmans@ifl.uni-karlsruhe.de, Frank Schönung, Stephan Mayer

Material Handling Systems are currently controlled by one or more layers of Controllers. This makes it tedious and risky to change those system in a running system. A new approach will be presented, which proposes a modular system of conveyors which are coordinated by a new protocol. This protocol ensures the necessary functionality by maintaining the decentralized character of the material handling system and providing the necessary informattion for topology and traffic.

3 - Flexible Bay Facility Layout by Ant Colony Search

Sadan Kulturel-Konak, Associate Professor, Penn State Berks, Management Information Systems, Reading, PA, 19610, United States of America, sadan@psu.edu, Abdullah Konak

An ant colony optimization (ACO) approach is proposed to solve the Facility Layout Problem (FLP) with unequal area departments and flexible bays which is a very common layout in many manufacturing and retail facilities. Optimal approaches to the FLP can only solve problems with a limited number of departments. The proposed ACO approach was tested on problems from the literature with up to 62 departments, and results are compared with the previously best known solutions.

4 - A Warehouse Without Aisles

Kevin Gue, Associate Professor, Auburn University, Department of Industrial and Systems Eng, Auburn, AL, 36849, United States of America, kevin.gue@auburn.edu, Kai Furmans

We describe a new high-density storage and material movement scheme that forms and collapses aisles as needed to retrieve or store items. The design effectively reduces the overall space devoted to aisles, but without the normal drawbacks of deep lane storage. We also provide some promising comparisons with traditional rack-in-aisle automated storage and retrieval systems.

■ SB26

C-Room 31B, Upper Level

Joint Session AAS/RM/TSL: Alliances, Revenue Management, and Robust Scheduling

Sponsor: Aviation Applications, Revenue Management & Transportation Science and Logistics
Sponsored Session

Chair: Milind Sohoni, Indian School of Business, India, milind_sohoni@isb.edu

1 - A Revenue Management Model for Joint Capacity Allocation and Overbooking over an Airline Network

Sumit Kunnumkal, Indian School of Business, AC4, Level 1, 4116, Hyderabad, AP, 500032, India, sumit_kunnumkal@isb.edu, Huseyin Topaloglu

We describe a revenue management model to jointly make the capacity allocation and overbooking decisions over an airline network. Our solution approach is based on building a approximation to the penalty cost that is separable by the numbers of reservations for the different itineraries. We present computational experiments that compare our approach with some standard benchmarks.

2 - Code Sharing

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu

In this paper we develop an optimization model the helps an airline decide on which flights in its network to code-share with its partner airlines. In this optimization model we consider demand cannibalization across the entire network, i.e., across all the markets served, when the airline opens a set of flights for codesharing. We use real data from a large airline to test our model and derive insights.

3 - Capacity-price Competition in Networks

Roger Lederman, Columbia Business School, New York, United States of America, rlederman13@gsb.columbia.edu, Nicolas Stier-Moses, Garrett van Ryzin

We model competition in markets with overlapping products, as in the case of airline flight legs included in multiple itineraries. The intensity of competition depends on the interactive effects between connected markets, as well as between each firm's product offerings. We analyze the flexibility of capacity across products, and study the equilibrium prices.

4 - An Empirical Investigation of Airline Flight Schedule Robustness

Mazhar Arikan, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States of America, marikan@purdue.edu, Milind Sohoni, Vinayak Deshpande

Flight delays have come under increased scrutiny lately, with on-time performance at one of its worst levels in 2007. In the first part of this study, we combine data published by BTS, with the newsvendor framework from the OM literature to examine the impact of the scheduled block time on overall service level. Specifically, we analyze the impact of flight block-times and aircraft turn-times on the schedule's robustness based on aircraft routings.

■ SB27

C-Room 31C, Upper Level

Joint Session Simulation/QSR: Quality and Reliability Methods in Simulation

Sponsor: INFORMS Simulation & Quality, Statistics and Reliability
Sponsored Session

Chair: K. Preston White, Jr., Professor, University of Virginia, P.O. Box 400747, 151 Engineers' Way, Charlottesville, VA, 22904-4747, United States of America, kpwhite@virginia.edu

1 - Verification of Design Requirements Using Monte Carlo Simulation and Variables Acceptance Sampling

K. Preston White, Jr., Professor, University of Virginia, P.O. Box 400747, 151 Engineers' Way, Charlottesville, VA, 22904-4747, United States of America, kpwhite@virginia.edu

Attributes acceptance sampling has been adapted to develop sampling plans for the verification of probabilistic design requirements using Monte Carlo simulation. While this approach has many advantages, attributes plans prescribe a large number of trials when requirements demand both high system reliability and high statistical confidence. In this paper we report on continuing research to develop smaller plans by adapting a related technique called acceptance sampling by variables.

2 - "Selection of the Best" Highly Reliable Simulation Model

Roy Creasey, Assistant Professor, Longwood University, College of Business and Econ, 201 High Street, Farmville, VA, 23909, United States of America, creaseyrr@longwood.edu, K. Preston White, Jr., Linda Wright, James Haug

SOTB problems are frequently encountered in Discrete Event Simulation. While much of the work has focused on expected performance analysis methods, their use for highly reliable models can lead to biased results. Also, a large number of observations in a replication or many replications are necessary. This research uses concepts from binomial theory to determine which of k>1 highly reliable models best meet the standard with a user-defined indifference zone and probability of correct selection.

3 - Risk Informed Resource Allocation for Navy Fire and Emergency Services

Ronald Woodaman, Principal Analyst, Innovative Decisions, Inc., 1945 Old Gallows Road, Suite 207, Vienna, VA, 22182, United States of America, rwoodaman@innovativedecisions.com, Carl Glover, Robert Liebe

The U.S. Navy Fire and Emergency Services Program expends over $300M a year to sustain a force of 420 apparatus and 3600 personnel in 185 fire stations and 56 fire departments around the globe. The Navy requires all budget submissions to be supported by accredited models, which must link requirements to resources at varying levels of risk tolerance. The authors describe the FESPOM model, which resources the Navy's fire departments by inherent risk levels and level of risk tolerance.

4 - Risk-Based Requirements and Resourcing for the Navy's Fire and Emergency Services Program

Ronald Woodaman, Operations Research Analyst, C4I Center, George Mason University, 4400 University Dr, Fairfax, VA, 22030, United States of America, rwoodama@gmu.edu, Carl Glover, Robert Liebe

The U.S. Navy Fire and Emergency Services Program expends over $300M a year to sustain a force of 420 apparatus and 3600 personnel in 185 fire stations and 56 fire departments around the globe. The Navy requires all budget submissions to be supported by accredited models, which must link requirements to resources at varying levels of risk tolerance. The authors describe the FESPOM model, which resources the Navy's fire departments by inherent risk levels and level of risk tolerance.

■ SB28

H-Room 500, Fifth Floor

Behavioral Issues in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Yuri Levin, Queen's University, Queen's School of Business, Kingston, ON, K7L 3N6, Canada, ylevin@business.queensu.ca

1 - Dynamic Pricing in the Presence of Strategic and Loyal Consumers

Benny Mantin, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L3G1, Canada, bmantin@engmail.uwaterloo.ca, Daniel Granot

We study a two-period dynamic pricing in the presence of both myopic and strategic consumers, where each type could be either loyal or opportunistic. While loyal consumers revisit the same retailer in the second period, opportunistic consumers switch to a competing retailer. We characterize the pricing scheme and the conditions under which strategic consumers purchase is deferred to the second period. We find that opportunistic behavior is not always the preferred outcome by strategic consumers.

2 - Speculative Behavior in a Queue

Andres Catalan, Doctoral Candidate, The Wharton School, University of Pennsylvania, 3730 Walnut St, #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, andresc@wharton.upenn.edu, Gerard Cachon, Senthil Veeraraghavan

Not all the customers waiting for a service actually want the service: sometimes people queue solely to make a profit from customers. We analyze the behavior of a speculator in a single queue that sells his position to the arriving customers. We find the price he will request and derive different thresholds in terms of queue length, system utilization and the speculator's waiting costs that lead him to behave speculatively (i.e. to hold his position and wait) to maximize his profit.

3 - Selling an Asset with Unknown Quality to Partially Informed Potential Buyers

Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

In this talk, I characterize the optimal pricing strategy for selling one asset (like a house) whose true value is unknown, to a stream of potential buyers that all have some noisy information about the true value and observe the full price history.

4 - Why Incorrect Models Forecast Better and Price Worse

Steven Shugan, Russell Berrie Eminent Scholar and Professor, University of Florida, 201 Bryan Hall Campus Box 117155, Gainesville, FL, 32611, United States of America, Steven.Shugan@cba.ufl.edu

This paper shows that incorrect models will provide better demand forecasts. Hence, over time, revenue management systems will favor incorrect models when systems are judged based on predictive accuracy. However, because the underlying model does not reflect true buyer price sensitive, pricing decisions will be incorrect. Consequently, predictive accuracy alone is insufficient to judge whether one system is better than another.

■ SB29

H-Room 501, Fifth Floor

Transmission Expansion Planning in Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Enzo Sauma, Dr., Pontificia Universidad Catolica de Chile, Santiago, Chile, esauma@ing.puc.cl

1 - A Two-tier Matrix Game Approach for Obtaining Joint Bidding Strategies in FTR and Energy Markets

Tapas Das, Professor, University of South Florida, Department of Industrial Eng, Tampa, FL, 33620, United States of America, das@eng.usf.edu, Patricio Rocha, Ehsan Salimi

Financial transmission rights (FTRs) allow the ISO to redistribute congestion revenue. Generators and loads bid for FTRs to hedge against congestion charges. Since the revenues from the FTR and energy markets are interdependent, each generator/load should have a joint bidding strategy for FTR and energy markets to maximize its total payoff. This paper presents a two-tier matrix game model to obtain these joint bidding strategies. We conduct a numerical validation by analyzing a 3 node network.

2 - Market-Driven Dynamic Transmission Expansion Planning
Javier Contreras, Associate Professor, Universidad de Castilla-La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, Spain, Javier.Contreras@uclm.es, José A. Aguado, Sebastiàn de la Torre, Alvaro Martìnez

Transmission expansion plays a key role in successful electricity markets because flawed expansion plans may create inefficiencies and dampen competition. One important aspect in the formulation of transmission expansion problems is the consideration of dynamic constraints that link decisions over different periods of the planning horizon. This presentation analyzes an efficient formulation of a dynamic transmission expansion problem in competitive pool-based electricity markets.

3 - Transmission Investment under Uncertainty: The Case of Germany-Norway
Ane Marte Heggedal, PhD-Student, Norwegian University of Science and Technology (NTNU), Alfred Getz vei 3, Trondheim, 7491, Norway, ane.m.heggedal@iot.ntnu.no, Afzal Siddiqui, Stein-Erik Fleten

Price differences between neighboring regions and countries motivate in part the construction of large transmission lines. Analysis of such investment are complicated the fact that we have uncertainty in prices and exchange rates, and also by the fact that the price differences between the regions become smaller after the transmission line has been put into operation. We perform a real options analysis of a merchant investor holding an exclusive license to build.

4 - Transmission Expansion under Uncertainty in Generation
Enzo Sauma, Dr., Pontificia Universidad Catolica de Chile, Santiago, Chile, esauma@ing.puc.cl, Jorge Vera, Fernando Traub

Power transmission systems may present many kinds of uncertainties that make hard a long-term planning of investments. These uncertainties are not only concerning demand, but also prices, generation capacities, faults, losses and operation system timing, among others. In this research work, we propose a grid planning methodology that considers generation capacity uncertainty. Specifically, we consider the uncertainty in the time when a power generator is plugged into the grid.

■ SB30

H-Room 502, Fifth Floor

Green Energy II

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

Co-Chair: Niko Iliadis, EnerCoRD, Plastira Street 4, Nea Smyrni, Athens, 171 21, Greece, niko.iliadis@enercord.com

Co-Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - Optimization of Conventional and Renewable Generator Dispatch
Jennifer Van Dinter, Graduate Student, Colorado School of Mines, 1500 Illinios Street, Golden, CO, 80401, United States of America, jvandint@mines.edu, James Milford, Donal O'Sullivan, Alexandra Newman

One challenge of integrating solar and wind energy into the electric grid is overcoming the intermittency of wind and solar resources by optimally dispatching conventional generating units and electricity storage devices. We develop a mixed integer program to minimize the insular system's fuel costs, while considering ramping limitations of conventional generators, the need for scheduled preventive maintenance outages, and the curtailment of solar and wind generators.

2 - Energy Policy Optimization Using Dirichlet Process Mixtures of Generalized Linear Models
Lauren Hannah, Princeton University, Department of ORFE, Sherrerd Hall, Charlton St., Princeton, NJ, 08540, United States of America, lhannah@Princeton.EDU, Warren Powell

Often, energy providers must make decisions when the optimal decision depends on a large, exogenous state variable. We use an online learning, Bayesian nonparametric framework to model the response (observed cost or revenue) as function of the decision and state. We apply our methods to an hourly wind supply commitment problem, where the commitment must be made using previous wind levels and spot market prices.

3 - Game Theoretic Analysis of Research Consortia for Tackling Climate Change
Gireesh Shrimal, Assistant Professor, Indian School of Business, Hyderabad, India, Gireesh_Shrimali@isb.edu

We look at industry consortia to develop technology where only a firm can utilize the technology, and characterize three regions. In the first, all firms join the consortia, whereas no firms join in the second. In the third both of these outcomes are possible. Second, we look at nation consortia, where even a non-member benefits, and again characterize three regions. Though the first two regions are the same as before, only a fixed number of nations join in the remaining one.

4 - Expert Judgments on Prospects for Cellulosic Biofuel Technology
Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu, Erin Baker

A promising direction in energy technology is to create fuels from cellulosic biomass feedstock. We elicited judgments from experts on the likelihood of achieving various performance targets with biofuels under a range of research funding scenarios. A methodological challenge was structuring these elicitations in a way that would lead to meaningful results for purposes of modeling economic value of the technology portfolio.

■ SB31

H-Room 503, Fifth Floor

Tutorial on Interfaces of Revenue Management with Operations and Marketing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Yossi Aviv, Professor of Operations Management, Washington University in St. Louis, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States of America, AVIV@WUSTL.EDU

1 - Tutorial on Interfaces of Revenue Management with Operations and Marketing: Strategic Consumer Behavior
Yossi Aviv, Professor of Operations Management, Washington University in St. Louis, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States of America, AVIV@WUSTL.EDU

Dynamic pricing and revenue management practices are gaining increasing popularity in the retail industry, and have engendered a large body of Management Science research. When applying dynamic pricing systems, retailers must account for the fact that, often, strategic customers may time their purchases in anticipation of future discounts. Such strategic consumer behavior might lead to severe consequences on the retailers' revenues and profitability. In recent years, researchers have developed mathematical models to explore various approaches for mitigating the adverse impact of this phenomenon. We will survey this body literature in this talk.

■ SB32

H-Room 504, Fifth Level

Risk Management: Models and Analysis

Cluster: Financial Engineering
Invited Session

Chair: Jeremy Staum, Northwestern University, Department of IEMS, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, j-staum@northwestern.edu

1 - Exact Simulation of Point Processes with Stochastic Intensities
Kay Giesecke, Assistant Professor, Stanford University, Management Science and Engineering, Stanford, CA, United States of America, giesecke@stanford.edu

Point processes with stochastic intensities can be simulated from standard Poisson arrivals by time-scaling with the cumulative intensity, whose path is typically generated with a discretization method. However, discretization introduces bias into the simulation results. This paper proposes a projection method for the exact simulation of point processes with stochastic intensities. It is illustrated for a point process whose intensity follows an affine jump-diffusion process.

2 - Too Interconnected to Fail: Contagion and Systemic Risk in Financial Networks
Rama Cont, Associate Professor, Columbia University, 500 W. 120th Street, New York, NY, 10027, Rama.Cont@columbia.edu

The financial crisis has underlined the importance of systemic risk and the lack of adequate indicators for quantifying it. We propose an indicator for the systemic importance of a financial institution which combines default correlation from common factors with direct contagion via counterparty exposures. We study the impact of network structure, leverage ratios and the role of credit default swaps in systemic risk.

3 - Implied Copula CDO Pricing Model: Entropy Approach
Alex Veremyev, PhD Student, University of Florida, 303 WEIL HALL, Gainesville, FL, 32611, United States of America, averemyev@ufl.edu, Tyrrell Rockafellar, Alex Nakonechnyi, Stan Uryasev

A so-called implied copula CDO pricing model is considered for calibrating obligor hazard rates. To find the probability distribution of the hazard rates we propose an entropy approach to the implied copula model. The distribution is found by maximizing entropy with no-arbitrage constraints based on bid and ask prises of CDO tranches. To reduce the noise a new class of CCC distributions is introduced. A case study shows that the entropy approach has a stable performance.

4 - Estimating Expected Shortfall with Stochastic Kriging

Ming Liu, Ph.D. Candidate, Northwestern University, 2145 Sheridan Road, Room C231, Evanston, IL, 60208, United States of America, ming-liu@northwestern.edu, Jeremy Staum

We present an efficient two-level simulation procedure which uses stochastic kriging, a metamodeling technique, to estimate expected shortfall. The outer level simulates financial scenarios and the inner level of simulation estimates the portfolio value given a scenario. Because expected shortfall involves the scenarios that entail the largest losses, our procedure allocates more computational effort to inner-level simulation of those scenarios, which also improves computational efficiency.

■ SB33

H-Room 505, Fifth Floor

Technology Change Management for Sustainability

Sponsor: Technology Management
Sponsored Session

Chair: Hsueh-Ming Wang, University of Alaska Anchorage, ESPM Department 3211 Providence Dr, Anchorage, AK, United States of America, afhsw1@uaa.alaska.edu

1 - Replacement Analysis of Small Off-Grid Nuclear Reactors

Lei Yao, University of Alaska Anchorage, 3901 Old Seward Highway, Anchorage, AK, 99503, United States of America, asly4@uaa.alaska.edu, LuAnn Piccard, Hsueh-Ming Wang

This research will focus on replacement analysis of ageing diesel generator systems in rural off-grid Alaskan communities. Marginal cost and annual equivalence analysis will be used to establish multiple-objective decision making process selection criteria to minimize life cycle cost, environmental impact, and disposal risk for small nuclear power generation systems.

2 - Patent Mapping for Forecasting the Technology Change of Light Emitted Diode (LED) Streetlights

LuAnn Piccard, Instructor, University of Alaska Anchorage, ESPM 3211 Providence Dr., Anchorage, AK, 99508, United States of America, aflp@uaa.alaska.edu, Hsueh-Ming Wang, Lei Yao

LED lamps are costly but energy efficient lighting systems. This research focuses on the application of the white LEDs used in streetlight applications, and investigates the morphology of LED patents including diode, bulb, structure, heat, fixture, and intelligent systems. The results demonstrate how local technology applications can foster global cooperation.

3 - Optimization Analysis of Warranty for the Technology Change of LED Streetlights

Oleg Bukhtiyarov, University of Alaska Anchorage, 727 Elm Street, 674, Anchorage, AK, 99501, United States of America, linousa@mail.ru, Hsueh-Ming Wang, LuAnn Piccard

LED streetlights may economically replace the traditional streetlights. The fast change of the streetlight technology causes the difficulty of determination of the warranty period. Forecasting based on stochastic iterations/infinitive modeling with dynamic change of product quality provides a warranty strategy for the market that maximizes their profit over time.

4 - Optimal Analysis of a Hybrid Solar-Wind Power Generation System with LPSP Technology for LED Lighting

Hsueh-Ming Wang, University of Alaska Anchorage, ESPM Department 3211 Providence Dr, Anchorage, AK, United States of America, afhsw1@uaa.alaska.edu, LuAnn Piccard, He Liu

This research explores a self-contained system using the renewable energy sources such as wind and solar and an energy saving load. Proposed is an algorithm to optimize the design of hybrid solar-wind power generation systems with Loss of Power Supply Probability (LPSP) technology for Light-Emitting Diode (LED) lights.

■ SB34

H-Room 520, Fifth Floor

Environmental Legislation and Green Supply Chain Management

Cluster: Green Supply Chain
Invited Session

Chair: Eda Kemahlioglu-Ziya, University of North Carolina- Chapel Hill, CB # 3490, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu

Co-Chair: Terry Taylor, Associate Professor, Haas School of Business, U.C. Berkeley, Berkeley, CA, 94611, United States of America, taylor@haas.berkeley.edu

1 - Competitors as Whistle-blowers in Enforcement of Product Standards

Erica Plambeck, Stanford Graduate School of Business, Memorial Way, Stanford, CA, 94305, United States of America, elp@stanford.edu

Under a product standards (eg RoHS, REACH) firms have an incentive to test competitors' products, reveal violations to the regulator, and thus gain market share. Often, regulators should rely entirely on competitive testing. Then, each firm's compliance effort increases with its product quality and with market concentration. In the long run, entry by small, low-quality firms and reduced quality investment will weakens compliance.

2 - Structural Efficiency in Take-Back Legislation

Atalay Atasu, Georgia Institute of Technology, Atlanta, GA, United States of America, Atalay.Atasu@mgt.gatech.edu, Oznur Ozdemir, Luk Van Wassenhove

We investigate the economics of two commonly implemented take-back legislation models: recycling fees and recycling rate mandates. We measure the efficiency of the two models from the perspectives of consumers, manufacturer(s), and the social planner for monopolistic and competitive environments and extend our analysis to possible scenarios with an externality of take-back rate assurance.

3 - Technology Choice and Emissions Flexibility in a Carbon Economy

David Drake, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, David.Drake@insead.edu, Paul Kleindorfer, Luk Van Wassenhove

Some 12,000 facilities in Europe now fall under a cap and trade system for carbon emissions. Technology choices for these facilities determine not only capacity and operating cost, but also firms' emissions profile. This paper extends the diverse technology literature to study capacity decisions under carbon regulation in build-to-order and build-to-stock environments. We characterize the optimal risk-neutral profit, emissions, and service level; comparing these to various heuristic approaches.

4 - Complying with Take-Back Legislation: A Cost Comparison and Benefit Analysis of Compliance Schemes

Eda Kemahlioglu-Ziya, University of North Carolina - Chapel Hill, CB # 3490, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu, Gokce Esenduran

We compare three compliance schemes (i.e. individual, collective and collaborative) that producers follow to comply with take-back legislations. We model each scheme as a two-stage Nash game and find the key market/operating conditions that make one scheme preferable to the others. However the most cost effective scheme may fall short on environmental benefits that the legislation is trying to achieve. Thus we also identify how collection/treatment levels compare between the three schemes.

■ SB35

H-Sapphire A, Fourth Floor

Stochastic Disease Modeling and Decision Making

Sponsor: Health Applications
Sponsored Session

Chair: Shengfan Zhang, North Carolina State University, Campus Box 7906, College of Engineering, Raleigh, NC, 27695, United States of America, szhang5@ncsu.edu

1 - Estimating the Likelihood of Cancer Progression for Prostate Cancer

Alex Tsodikov, Professor of BIostatistics, University of Michigan, 1420 Washington Heights, Ann Arbor, MI, 48109, United States of America, tsodikov@umich.edu

Nowadays a lot of cancers are over-diagnosed and do not need treatment. The key question of disease management is whether cancer would progress if left untreated. Since few if any patients are left untreated on diagnosis, the disease progression within the subject is unobserved. Statistical approaches to the problem are discussed, and the methodology is applied to estimate the likelihood of cancer progression from cancer registry SEER data.

2 - Estimating the Likelihood of Cure From Lung Cancer

Ray Lin, PhD Candidate, Stanford University, 1201 Welch Road, Room P284, Stanford, CA, CA94305, United States of America, raylin@stanford.edu, Sylvia Plevritis, Bronislava Sigal

Lung cancer is the leading cause of cancer death, yet screening is not recommended. A stochastic model of the natural history of lung cancer was developed to estimate the relationship between the size of the primary tumor and the likelihood of cure. Model parameters were estimated using survival data from SEER cancer registry and validated on Mayo Lung Project. Our findings indicate that most lung cancer patients may be cured if the primary tumor is detected and treated in the millimeter-range.

3 - Modeling Disease Spreading on Networks

Lauren Gardner, University of Texas at Austin, Austin, TX, lmgardner@mail.utexas.edu, David Fajardo, Travis Waller

The spread of infectious diseases is an inherently stochastic process. Real time control and prediction methods present a huge challenge due to the dynamic and stochastic nature of the problem combined with imperfect information. The focus of this work is on the development of a stochastic network model that can be used for predicting disease propagation through a population, and evaluating potential real-time intervention strategies.

4 - Inverse Breast Cancer POMDP Model

Kuang-Hao Yeh, North Carolina State University, Daniels Hall, NCSU, Raleigh, NC, 27695, United States of America, kyeh@unity.ncsu.edu

The identification of an optimal screening policy requires an understanding of the cost (monetary and quality of life) of breast cancer. We develop a POMDP model of breast cancer assuming that the current screening recommendation is optimal and perform an inverse algorithm to find the implied reward function associated with the current policy.

5 - Modeling Mortality Probabilities for Breast Cancer Patients Using Screening Registry Data

Shengfan Zhang, North Carolina State University, Campus Box 7906, College of Engineering, Raleigh, NC, 27695, United States of America, szhang5@ncsu.edu, Julie Ivy, Kathleen Diehl

We use population-based Carolina Mammography Registry Data to estimate mortality probabilities for breast cancer patients. A competing risks model is developed to estimate breast cancer, comorbidity, and all other causes death probabilities as a function of patient age, race, stage at diagnosis and screening behaviors. Left censoring is incorporated to represent the actual start time of breast cancer before the diagnosis. The estimated probabilities are also adjusted to represent US population.

■ SB36

H-Sapphire B, Fourth Floor

Healthcare / Treatment Management-Cancer

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - Cancer Patient Treatment Planning

Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

Cancer treatments are usually delivered in sequence of sessions from day to years. The long term planning improves not only the patients' waiting times and quality of life, but also the safety of treatment procedures and healthcare resource usages. Based on the growing detail of patient cancer development stage, treatment plan can be reoptimized along with newly available techniques during the course of patient treatment. Analysis on model constructed will be carried out over a public database.

2 - A New On-line Re-optimization Model for IMRT Treatment Planning

Chunhua Men, University of California, San Diego, Department of Radiation Oncology, 3855 Health Sciences Dr., La Jolla, CA, 92093, United States of America, cmen@ucsd.edu, Xuejun Gu, DJ Choi, Amit Majumdar, Steve Jiang

The Fluence Map Optimization (FMO) for Intensity Modulated Radiation Therapy (IMRT) is a large-scale problem and it is a bottle-neck for online re-optimization. We present a new re-optimization model which avoids re-verification by physicians. We solve it using interior point method and gradient projection method with clinical data. We show that such algorithms can be solved much more efficient on the Graphics Processing Units (GPUs) which have highly parallel nature than the traditional CPUs.

3 - Patient Pathway Scheduling: A Case Study

Alessandro Condotta, School of Computing, University of Leeds, University of Leeds, Leeds, LS2 9JT, United Kingdom, condotta@comp.leeds.ac.uk, Natalia V. Shakhlevitch

A key reform in the UK healthcare system involves the concept of patient pathway management. Scheduling all appointments for a patient offers a number of advantages in comparison with the traditional policy of booking one appointment at a time. We study a new combinatorial optimization problem related to the chemotherapy pathway. The suggested solution procedure results in improved resource usage, patients' waiting times and procedure safety.

■ SB37

H-Sapphire C, Fourth Floor

Supplier Management and Selection

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Karen Donohue, Associate Professor, Carlson School, University of Minnesota, 321 19th Ave S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, donoh008@umn.edu

1 - Strategic Positioning for High-Tech Contract Manufacturers

S. David Wu, Dean, College of Engineering, Lehigh University, 19 Memorial Drive West, Bethlehem, PA, 18015, United States of America, sdw1@Lehigh.EDU, Banu Gemici-Ozkan

We investigate contract manufacturers' (CM) incentive to develop their own market presence. We analyze their strategic market entry decision under a wide range of conditions. Our aim is to establish theoretical foundations that can be cross-referenced with empirical-based market entry research in the literature, while deriving new insights. We further our analysis on the strategic interactions between the brand-carrying customer and the contract manufacturer.

2 - An Empirical Analysis of Price, Quality and Incumbency in Online Procurement Auctions

Tunay Tunca, Associate Professor, Graduate School of Business, 518 Memorial Way, Stanford University, Stanford, CA, 94305, United States of America, tunay@stanford.edu, Vivian Zhong, DJ Wu

Using data from legal service procurement auctions, we study how online auctions can be used fairly and effectively in procuring business services, and demonstrate the roles supplier quality and incumbency play in this process. We theoretically show and empirically demonstrate how an open ended auction format can significantly boost a buyer's savings from an online auction and explore the role of incumbency in award decisions.

3 - Stability of Group Purchasing Organizations

Greys Sosic, Associate Professor, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, United States of America, sosic@marshall.usc.edu, Mahesh Nagarajan, Hao Zhang

GPOs exist in several sectors and benefit its members through quantity discounts and negotiation power when dealing with suppliers. However, GPOs may suffer from member dissatisfaction due to unfair allocations of the savings. We consider several allocation mechanisms and identify stable buyer alliances for them. We look at discount schedules that seem to encompass a large class of practical schedules and analyze both exogenous and endogenous purchasing requirements of the members.

4 - Optimal Service-Based Procurement Design: Competition versus Incentive Contracts

Ehsan Elahi, Assistant Professor, UMass Boston College of Management, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, ehsan.elahi@umb.edu, Karen Donohue, Saif Benjaafar

We consider a procurement problem in which a buyer wishes to maximize profit by maximizing the service levels suppliers provide. The buyer can induce suppliers to provide higher service levels either through orchestrating a service-based competition or through designing an incentive contract in which suppliers are rewarded based on the service levels they provide.We show optimal forms of these two mechanisms and compare the result with the buyer's profit when there is a central decision maker.

■ SB38

H-Sapphire D, Fourth Floor

Approximate Dynamic Programming for Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Adam Mersereau, Asst. Professor, University of North Carolina, Kenan-Flagler Business School, CB #3490, Chapel Hill, NC, 27599-3490, United States of America, ajm@unc.edu

1 - Contract Portfolio Optimization for a Gasoline Supply Chain
Shanshan Wang, swang5@chicagobooth.edu, Dan Adelman

We consider one supplier selling one product through three channels: branded (long-term), unbranded (short-term) and spot. We address a finite horizon problem, with the objective of finding the optimal contract portfolio constrained by future market conditions and contractual obligations to maximize the total expected discount profit. We characterize the optimal policy and provide both analytical and numerical results.

2 - A Dual Approach for Bounds in Stochastic Inventory Models
James E. Smith, Professor, Fuqua School of Business, jes9@duke.edu, Peng Sun, David Brown

When studying complex inventory systems, researchers often propose heuristic policies and use simulation methods to estimate the expected costs of a policy. In this talk, we will describe a dual approach that provides a lower bound on the optimal expected costs. This dual approach can help determine whether a proposed policy is "good enough" and identify ways to improve the policy. We illustrate this approach with an inventory system with non-stationary, unobserved demand process.

3 - Dynamic Capacity Allocation to Customers Who Remember Past Service
Adam Mersereau, Asst. Professor, University of North Carolina, Kenan-Flagler Business School, CB #3490, Chapel Hill, NC, 27599-3490, United States of America, ajm@unc.edu, Dan Adelman

We study the problem faced by a supplier deciding how to dynamically allocate limited capacity among a portfolio of customers who remember the fill rates provided to them in the past when making ordering decisions. Customers differ from one another in the prices they are willing to pay, in their sensitivity to past fill rates, and in their demand variance. We seek to understand the impacts of these factors on the supplier's allocation policy.

■ SB39

H-Sapphire E, Fourth Floor

Healthcare Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Hui Zhao, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, zhaoh@purdue.edu

1 - Inventory Management under Shipment Errors
Leroy Schwarz, Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47906, United States of America, lschwarz@purdue.edu, Vinayak Deshpande

This research examines the consequences of product misidentification leading to shipment errors using a two-product 'newsvendor' model in which ordering and/or receiving mistakes occur with known probabilities. We establish that the form of the optimal policy is a state-dependent base-stock policy. We are also able to analytically establish the sensitivity of the corresponding base stocks (and safety stocks) to model parameters and inventory levels.

2 - The Impact of "Inventory Management Agreements" on Pharmaceutical Supply-Chain Inventory
Leroy Schwarz, Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47906, United States of America, lschwarz@purdue.edu, Hui Zhao

Until 2002, a significant portion of pharmaceutical distributors' gross margin was earned by "investment buying". Today, investment buying is mostly gone. Instead, manufacturers and distributors have Inventory Management Agreements (IMAs), under which manufacturers limit distributor purchases and distributors report inventories and sales. This research examines the impact of Inventory Management Agreements on the size of inventories pharmaceutical supply chain inventory.

3 - The Value of Information in the Pharmaceutical Distribution Chain
Chuanhui Xiong, Purdue University, Krannert School of Management, West Lafayette, United States of America, cxiong@purdue.edu, Hui Zhao, Leroy Schwarz

Pharmaceutical distributors experienced a switch from IB (Investment Buying) model motivated by continuous price increases to FFS (Fee For Service) and IMA (Inventory Management Agreement) model. We demonstrate the impact of price increases to the manufacturer in the IB model, fee structures in the FFS model, and correspondingly the value of demand information under FFS and IMA. We also compare these two different models.

4 - Clinic Overbooking and Patient Responses: A Game Theoretical Analysis
Hui Zhao, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, zhaoh@purdue.edu, Mark Lawley, Bo Zeng

We consider the impact of overbooking on two most important factors of patient no-show: appointment delay and patients' dissatisfaction. While overbooking increases patients' office waiting time (office delay), it reduces the lag between making an appointment and seeing the doctor (appointment delay). We use a game theoretic framework and a queueing model to characterize these two effects and obtain more comprehensive evaluation of overbooking on clinic overbooking.

■ SB40

H-Sapphire H, Fourth Floor

Tutorials: Financial Engineering

Sponsor: Financial Services
Sponsored Session

Chair: Chanaka Edirisinghe, Professor, University of Tennessee, College of Business, Knoxville, TN, United States of America, chanaka@utk.edu

1 - Applying Dynamic Portfolio Theory: Lessons From the 2008 Crash
John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

Numerous investors needlessly lost much of their wealth in 2008. We discuss contributing factors: inertia, changing correlations/contagion, volatility, and static investment planning and extend traditional portfolio models. Topics include: 1) integrating assets, liabilities, and goals; 2) transaction costs; 3) multiple regimes; 4) short time-steps; and 5) importance of liquidity. Advantages of dynamic strategies are shown by reference to historical backtests and a Princeton-based hedge-fund.

2 - Optimization Approaches in Credit Risk
Stan Uryasev, University of Florida, Department of Industrial and Systems Engineer, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, uryasev@ufl.edu

This tutorial will discuss several optimization models in credit risk management. We will consider optimization problem statements and present numerical case studies for the following problems: 1) Optimization of positions in a portfolio of bonds 2) Optimal structuring of Collateralized Debt Obligations (CDOs) 3) Estimating credit default distributions with Maximum Entropy Approach.

■ SB41

H-Sapphire L, Fourth Floor

Threats to Life and Limb

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Arnie Barnett, MIT, Cambridge, MA, United States of America, abarnett@mit.edu

1 - Re-assessing the Threat: Redemption in the Face of Criminal Records
Alfred Blumstein, Carnegie-Mellon University, Heinz College, 5000 Forbes Avenue, Pittsburgh, PA, 15213, ab0q@andrew.cmu.edu, Kiminori Nakamura

With the growing ubiquity of background checking, and also of criminal-justice encounters, many people are denied jobs because of a stale criminal record. Since hazard rate declines with time clean, we provide the first empirical estimates of redemption times from the earlier event based on reasonable compliance criteria.

2 - Cross National Differences in Aviation Safety Records
Arnie Barnett, MIT, Cambridge, MA, United States of America, abarnett@mit.edu

The passenger death risk on a randomly-chosen airline flight in the world is about one in three million. But, much as the center of mass of a doughnut is at the center of the hole—where there is no mass—there are few if any countries in which the mortality risk of air travel is one in three million. Rather, there is considerable heterogeneity in aviation risk across nations, which we explore in an analysis of fatal-accident data from 2000-08.

3 - The 2009 H1N1 Virus: What is Happening?
Richard Larson, Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-233, Cambridge, MA, 02139, United States of America, rclarson@MIT.EDU, Stan Finkelstein

We model the spread and consequences of the H1NI virus in 2009, based on data about its rise and diffusion starting in the spring of this year.

■ SB42

H-Sapphire P, Fourth Floor

Managing Variability in Supply Chains

Contributed Session

Chair: Sudarsan Rangan, Texas A&M University, 4217 TAMU, College Station, TX, 77840, United States of America, srangan@mays.tamu.edu

1 - Measuring the Variability in Supply Chains with the Peakedness: Model and Application to FMCG
Ying Wei, Post-doctoral Fellow, CORE, Louvain-la-Neuve, 1348, Belgium, ying.wei@uclouvain.be, Philippe Chevalier, Jean-Christophe Van den Schrieck

We introduce a novel way to measure the variability of flows in supply chains, the peakedness. We are able to estimate the peakedness from arrival data, and characterize demand, forecast and inventory based on the peakedness functional. In addition, we can predict the variability in single and multi-stage inventory systems, and tree-structured supply chains. Based on real life data for fast moving consumer goods (FMCG), we compare the results of the peakedness approach with that of simulation.

2 - Modeling and Analysis of the Impact of Demand Seasonality on Post-merger Synergy
Li Tan, Assistant Professor, Washington State University, 2710 University Drive, Richland, WA, 99354, United States of America, litan@wsu.edu, Shenghan Xu

M&As bring opportunity for companies to streamline supply chains. To fully benefit from the possible synergy, a merged company has to consider how the seasonal demand patterns of its original and adopted products may affect logistic cost. We model and analyze supply-chain consolidation of various settings, and we study the seasonal demand variance of products and study its impact on post-merger synergy. We propose two metrics for demand seasonality and identify their relations to the synergy.

3 - An Empirical Model to Assess the Effectiveness of Supply Chain Collaboration
Amarpreet Kohli, University of Southern Maine, P.O.Box 9300, Portland, ME, 04104, United States of America, akohli@usm.maine.edu, John Jensen

Social or technical factors have been observed to influence successful supply chain relationships. This research proposes an instrument to measure the impact of factors viz. goal congruence, personal interaction, trust, nature of collaboration and environmental variables on the effectiveness of supply chain collaboration. Preliminary results suggest that personal interaction and trust may not be as significant a predictor of operational effectiveness as goal congruence.

4 - Seafood Value Chain and Supply Chain Optimization
Yousaf Shad Muhammad, NTNU, Alfred Gtz veg 3, 10 etg, Trondheim, Norway, yousaf@iot.ntnu.no, Asgeir Tomasgard

We are presenting a seafood value chain model about optimal use of logistics and installed facilities on multiple locations. Complex processing of seafood is addressed in the model. This is a problem of products, locations, and a supply chain design. The objective of study is to develop tools for the management by structuring an optimization model that accommodates the operational complexity of the economical modeling of resources, logistics, yield management and market demand under uncertainty.

5 - Distributor's Integrated Inventory and Outbound Shipment Decisions
Sudarsan Rangan, Texas A&M University, 4217 TAMU, College Station, TX, 77840, United States of America, srangan@mays.tamu.edu, Malini Natarajarathinam, Ismail Capar

This analysis is based on a problem faced by a spare parts distributor that supplies n retailers. The distributor has to decide on his inventory system and replenish retailer inventories using a VMI policy. We analyze this problem to provide optimal inventory acquisition and shipment decisions to minimize the overall cost at the distributor.

■ SB43

H-Room 400, Fourth Floor

Mitigating Supply Chain Disruptions

Cluster: Supply Chain Models

Invited Session

Chair: Larry Snyder, Assistant Professor, Lehigh University, Department of Industrial & Systems Eng, 200 West Packer Ave., Mohler Lab, Bethlehem, PA, 18015, United States of America, larry.snyder@Lehigh.EDU

1 - A Continuous-review Inventory Model with Dual-sourcing Strategy and Random Disruptions
Lian Qi, Rutgers, The State University of New Jersey, 1 Washington Park, Room 962, Newark, United States of America, lianqi@business.rutgers.edu

We consider a continuous-review inventory problem for a retailer facing constant demand. This retailer can source from two suppliers who differ in reliability and cost. Supplier 1 is cheaper, but is subject to random disruptions; Supplier 2, the backup supplier, is more expensive, but is perfectly reliable. We identify the optimal inventory and sourcing strategy at the retailer, to reduce the impact of the random disruptions at the primary supplier on its expected working inventory cost.

2 - Supply Disruptions in One-Warehouse Multiple-Retailer Systems
Zumbul Bulut, Ph.D. Candidate, Lehigh University, Mohler Lab., Allentown, PA, 18015, United States of America, zub205@lehigh.edu, Larry Snyder

We examine the impact of supply disruptions on the OWMR systems with non-identical retailers and deterministic demand. We obtain the exact expressions of the stocking levels when disruptions happen at the supply processes of the retailers and develop a heuristic procedure for disruptions in the warehouse's supply system. We propose approximate methods to obtain the stocking levels of the system with non-overlapping and overlapping disruptions at both the warehouse and the retailers.

3 - Insights From a Practical Application of Supply Chain Disruption Modeling
Amanda Schmitt, Postdoctoral Associate, MIT Center for Transportation and Logistics, 77 Massachusetts Ave., E40-266, Cambridge, MA, 02139, United States of America, aschmitt@mit.edu, Mahender Singh

We present results from analysis performed at a major consumer products company to assess disruption risk in their supply chain. The project includes a Monte Carlo simulation, developed to estimate disruption distributions, and a discrete-event simulation, developed to capture interactions in the multi-echelon network. We present results evaluating the impact of disruptions and mitigation responses in the network and discuss insights from the project.

4 - Managing Supply Chain Disruption and Competition
Biying Shou, City University of Hong Kong, Tat Chee Ave., Kowloon, Hong Kong - ROC, biying.shou@cityu.edu.hk, Erick Zhaolin Li, Jianwei Huang

We consider a market with two competing supply chains subject to supply disruptions. The retailers engage in Cournot competition by determining order quantities from their exclusive suppliers. We analyze the equilibria with different supply chain contracts and show that supply chain coordination is a dominant strategy. Moreover, we show that investment in supply chain coordination may or may not result in positive gains for the supply chain.

■ SB44

H-Room 402, Fourth Floor

Joint Session Service Science/Data Mining: Service Quality

Sponsor: Service Science & Data Mining

Sponsored Session

Chair: Fugee Tsung, Professor, Hong Kong University of Science and Technology, Department of IELM, Hong Kong University of Sci. & Tech., Hong Kong, Hong Kong - PRC, season@ust.hk

Co-Chair: Wei Jiang, United States of America, jiangwei08@gmail.com

1 - Statistical Quality Techniques to Service Science and Engineering
Fugee Tsung, Professor, Hong Kong University of Science and Technology, Department of IELM, Hong Kong University of Sci. & Tech., Hong Kong, Hong Kong - PRC, season@ust.hk

With the shift in economic focus from manufacturing to service, industrial and academic research facilities may need to apply more scientific rigor to the practices of service, such as discovering better methods to use statistics to increase quality and productivity to meet the challenges. This talk will focus on the development of statistical quality techniques, and discuss several technical challenges and recent extensions to the service engineering research area.

2 - Transfer Learning of Graphical Models with Application in Alzheimer's Studies

Jing Li, Assistant Professor, Arizona State University, Tempe, United States of America, jing.li.8@asu.edu, Shuai Huang

This research develops a method to learn Gaussian Graphical Models from data for multiple related tasks. The method enables the knowledge gained during the learning of one task to be transferred to help the learning of another related task. An application in brain connectivity modeling of Alzheimer's disease is provided.

3 - Data Stream Clustering and Modeling Using Context-Trees

Wei Jiang, United States of America, jiangwei08@gmail.com, Pierre Brice

Many context-dependent models that deal with categorical or mixedvalue data streams are not scalable. This paper proposes a clustering method for generating them around relevant aggregates of these data streams rather than the individual samples. Both theoretical and experimental evaluations of the technique are obtained to compare with other prominent clustering techniques for categorical data streams.

■ SB45

H-Room 410, Fouth Floor

Panel Discussion: Teaching Interdisciplinary Courses in Product Design and Development

Cluster: New Product Development
Invited Session

Chair: Sebastian Fixson, Babson College, Tomasso 226, Babson Park, MA, 02457, United States of America, sfixson@babson.edu

1 - Teaching Interdisciplinary Courses in Product Design and Development

Moderator: Sebastian Fixson, Babson College, Tomasso 226, Babson Park, MA, 02457, United States of America, sfixson@babson.edu, Panelists: Sara Beckman, Manuel Sosa, Nitin Joglekar, Michael Meyer, William Lovejoy

Come and join us for a discussion of the past, present, and future of interdisciplinary courses in product design and development (PDD). Our panel of accomplished teachers who have successfully developed and executed their versions of PDD courses will share their experiences, insights, and advice.

■ SB46

H-Room 411, Fourth Floor

Knowledge, Learning, Intellectual Captial (KLIC) - 1: The Dynamics of Learning

Sponsor: Technology Management
Sponsored Session

Chair: Charles Weber, Porland State University, P.O. Box 751 — ETM, Portland, OR, 97207, United States of America, charles.weber@etm.pdx.edu

1 - Status in Open Innovation Contests

Cheryl Druehl, Assistant Professor, George Mason University, School of Management, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu

Firms such as InnoCentive act as intermediaries between companies with problems to solve (seekers) and individuals offering solutions (solvers). I incorporate status as a motivation into a model of solver participation with the goal of understanding how to design contest environments.

2 - How Delays Complicate Organizational Learning

Hazhir Rahmandad, Assistant Professor, Virginia Tech, 7054 Haycock Road, Room 430, Falls Church, VA, 22043, United States of America, hazhir@vt.edu

From investing in product development to burning fossil fuels and spending time on education, delays between taking actions and observing the results are pervasive in individual, organizational, and social settings. In this talk I summarize the major mechanisms through which these delays complicate learning and thus can lead to inefficient allocation of resources and decision-making biases.

3 - Knowledge Sharing in Communities: The Role of "Community Munificence"

Zeynep Erden, Doctoral Candidate, ETH Zuerich, KPL G 13, Kreuzplatz 5, Zuerich, ZH, 8032, Switzerland, zerden@ethz.ch, Seonwoo Kim, Georg von Krogh

Understanding why people intend to share or avoid sharing knowledge in a community is crucial for the community performance and outcomes. Yet, the role of "community" in explaining why people intend to share knowledge has not been studied in organizational knowledge creation literature. The goal of this paper is to fill the gap in the literature by looking at what community provides to the members that shapes the intentions to share knowledge.

4 - Radical Organizational Learning, Circadian Rhythms and the Broad Structure

Charles Weber, Associate Professor, Portland State University, Engineering and Technology Mangement, P.O. Box 751, Portland, OR, 97201, United States of America, webercm@gmail.com

The theory of punctuated equilibrium associates radical change with the disruption of an organization's deep structure. An empirical study of semiconductor photomask manufacturing suggests that radical improvement in organizational performance is contingent upon synchronizing circadian rhythms across a stable broad structure of organizations within and outside the firm.

■ SB47

H-Room 412, Fourth Floor

2009 Dantzig Dissertation Award Finalists

Cluster: George B. Dantzig Disseration Prize
Invited Session

Chair: M. Eric Johnson, Professor, Dartmouth College, Tuck School of Business, 100 Tuck Hall, Hanover, NH, 03755, United States of America, M.Eric.Johnson@tuck.dartmouth.edu

1 - Optimal Management of Mammography Findings for Breast Cancer Diagnosis: Patient's Perspective

Jagpreet Chhatwal, Health Economist, Merck Research Laboratories, North Wales, PA, 19454, United States of America, jagpreet_chhatwal@merck.com, Oguzhan Alagoz, Elizabeth Burnside

We address several issues with the current practice of breast cancer diagnosis including unnecessary biopsies and follow-up imaging. We use Markov decision processes and risk prediction models (Bayesian networks and logistic regression) to develop optimal policies that maximize a patient's quality-adjusted life expectancy. We investigate several structural properties and provide their clinical intuitions. Our results show better decision-making when compared to the current clinical practice.

2 - Pre-launch Forecasting of New Product Diffusions

Evren Ozkaya, Associate Consultant, McKinsey & Company, 9204 Madison Dr, Atlanta, GA, 30346, United States of America, evren_ozkaya@mckinsey.com, John Vande Vate, Michael Waithe, Pinar Keskinocak

In this paper, we present a practical framework for the analysis of historical product diffusion patterns and propose several methodologies for algebraically estimating new product diffusion parameters. We introduce user-friendly versions of the classic Bass Diffusion Model with new sets of parameters that are more intuitive and have natural interpretations. We test our models on real-world data sets from the high-tech industry and report significant forecast improvement opportunities.

3 - Modeling the Choice of an Airline Itinerary and Fare Product Using Booking & Seat Availability Data

Emmanuel Carrier, AI Systems, 3500 Carillon Point, Kirkland, WA, United States of America, ecarrier@MIT.EDU, Moshe Ben-Akiva, Peter Belobaba

In this paper, we develop a methodology to analyze the choice of an airline itinerary and fare product based on booking data. To incorporate the impact of airline pricing and RM and reconstruct the passenger choice set, booking data is combined with fare rules and seat availability data. In addition, characteristics of the traveler and the trip are retrieved and used to estimate a latent class choice model providing an alternative to the traditional segmentation based on trip purpose.

4 - Disruption Risk Management and Supply-Chain Resilience

Nitin Bakshi, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nbakshi@london.edu

In this thesis we highlight the role played by collaboration in supply-chain risk management. We first mathematically characterize the notion of collaboration and underline the improvements over a non-cooperative approach. Next, we consider the specific context of protecting the containerized supply chain against terrorist attacks. Using game theory, queueing models and discrete event simulation we analyze container security at US domestic and international ports.

5 - Internet Advertising: Optimization and Economic Aspects
Hamid Nazerzadeh, Post-doc Researcher, Microsoft Research, One Memorial Dr, Cambridge, MA, United States of America, hamidnz@microsoft.com

Internet advertising is a very large-scale market where the supply is associated with pageviews of the users, and the demand is associated with advertisers with complex preferences. In this dissertation, I present mechanisms that address some of the challenges that emerge in this market.

■ SB48

H-Sapphire Green Room, Fourth

Service Scheduling & Operational Efficiency

Sponsor: Service Science
Sponsored Session

Chair: Sanjeev Bordoloi, Associate Professor, University of St Thomas, Opus College of Business, 1000 LaSalle Ave., TMH 443, Minneapolis, MN, 55403, United States of America, bord9806@stthomas.edu

1 - Combining Integer Programming and the Randomization Method to Schedule Employees
Armann Ingolfsson, Associate Professor, University of Alberta, Edmonton, CA, T6G2R6, Canada, Armann.Ingolfsson@ualberta.ca

We present a method to find low cost shift schedules with a time-varying service level above a specified minimum. The method calculates transient service levels with the randomization method and generates schedules with an integer programming heuristic. The resulting schedules are near-optimal and considerably less costly than schedules generated with simpler heuristics. Computational times are substantially shorter than with a method that guarantees optimality.

2 - Stabilizing Abandonment in Many-Server Queues with Time-Varying Arrivals
Yunan Liu, Student, Columbia University, 560 Riverside Drive, #4B1, New York, NY, 10027, United States of America, yl2342@columbia.edu, Ward Whitt

We propose a new offered-load approximation involving infinite-server models to determine time-dependent staffing levels to stabilize abandonment probabilities and expected delays at target levels in the M_t /GI/s_t + GI many-server queueing model, having time-varying arrivals (the M_t) and allowing non-exponential customer abandonment (the +GI). With the new offered load, a square-root-staffing formula is remarkably effective over a wide range of loads.

3 - Specialty Hospitals and Hospital Efficiency in the U.S.
Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

Over the last 15-20 years, general hospitals have faced a new competition from for-profit specialty hospitals that operate on a focused factory model and are threatening to siphon-off the most profitable patients. This paper will attempt to compare the efficiency of general hospitals and specialty hospitals in the United States using stochastic frontier regression analysis.

4 - Shift Scheduling in Multiskill Call Centers
Ger Koole, VU University Amsterdam, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, koole@few.vu.nl, Sandjai Bhulai, Auke Pot

We introduce a new method for shift scheduling in multiskill call centers. The method consists of two steps. First, staffing levels are determined, and next, in the second step, the outcomes are used as input for the scheduling problem. The scheduling problem relies on a linear programming model that is easy to implement and has short computation times.

5 - Staffing Decisions in Healthcare Operational Efficiency
Sanjeev Bordoloi, Associate Professor, University of St Thomas, Opus College of Business, 1000 LaSalle Ave., TMH 443, Minneapolis, MN, 55403, United States of America, bord9806@stthomas.edu

Healthcare industry, as a major service provider, is undergoing major reforms lately. The operational efficiency in healthcare depends heavily on its human resources, namely physicians and nurses, which is also a major component of the healthcare costs. This makes it imperative to manage human resources efficiently. This paper takes a critical look at the staffing decisions in healthcare and provides a basic model to minimize costs while maintaining operational quality and efficiency.

■ SB49

H-Room 300, Third Floor

Project Scheduling

Cluster: Project Management
Invited Session

Chair: Willy Herroelen, Emeritus Professor, K.U.Leuven, Naamsestraat 69, Research Center for Operations Mgmt., Leuven, B-3000, Belgium, Willy.Herroelen@econ.kuleuven.be

1 - Measuring Slack in Stochastic Activity Networks
Gary Mitchell, Assistant Professor, University of Portland, 5000 N. Willamette Blvd, Portland, OR, OR 97203, United States of America, mitchelg@up.edu, Ted Klastorin

The concept of slack in deterministic activity networks is well developed in the project management literature. However, there has been little discussion of slack measures in stochastic activity networks. How should stochastic slack measures be calculated? How can practitioners use stochastic slack and related concepts to better manage projects? In this paper we address these questions and present an approach for determining slack time distributions and useful summary measures.

2 - Impact of Agility on Project Duration
Karolina Glowacka, Assistant Professor, Stevens Institute of Technology, Hoboken, NJ, United States of America, kglowack@stevens.edu, Richard Wendell, Timothy Lowe

Project scheduling typically assumes that an activity begins as soon as its predecessors are completed. Thus, if all predecessors of an activity finish ahead of schedule, the activity begins early. Unfortunately in practice activities may not be forward agile in capturing the benefits of starting early. We investigate the impact on project duration when projects lack such forward agility. Specifically, we evaluate the impact on the probability of achieving a target time for finishing a project.

3 - Resource-constrained Project Scheduling under Activity Duration Variability
Filip Deblaere, PhD Student, K.U.Leuven, Naamsestraat 69, Leuven, Belgium, filip.deblaere@econ.kuleuven.be, Willy Herroelen, Erik Demeulemeester

The resource-constrained project scheduling problem involves the determination of a baseline schedule of the project activities, satisfying the precedence relations and resource constraints while minimizing the project duration. In practice, activity durations may be subject to variability that render the execution of the schedule impossible. We propose a methodology for the determination of a project execution policy that attempts to minimize the expected activity starting time deviations.

4 - On the Optimal Choice of Activity Modes in Robust Project Scheduling
Erik Demeulemeester, Professor, K.U.Leuven, Naamsestraat 69, Leuven, Belgium, erik.demeulemeester@econ.kuleuven.be, Wendi Tian

The critical chain scheduling and buffer management approach, proposed by Goldratt, has proven to be a good way to robustly schedule resource-constrained projects. However, in this problem one considers the modes for each activity to be fixed. In our research, we consider the multi-mode version of the problem and we try to determine the optimal choice of the activity modes when the objective is to schedule the project as robust as possible. Extensive computational results will be provided.

■ SB51

H-Room 303, Third Floor

Advances in Linear and Convex Programming Applications and Algorithms

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

1 - Using Linear Assignment for Accelerated Protein Configuration Calculations
Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

We aim to compute free-energy (FE) differences between protein conformations by using a transformation of a source conformation into a target conformation. Such calculations are crucial for computing-based drug design. To enhance the transformation procedure we seek to find the permutation that minimizes the

mean-square distance traveled by the atoms. The best permutation can be found quickly by solving a linear assignment problem and significantly improves the efficiency of FE calculations.

2 - A Nonstandard Simplex Algorithm for Linear Programming
Ping-Qi Pan, Professor, Southeast University, Department of Math., Southest University, Nanjing, 210096, China, panpq@seu.edu.cn

With the simplex framework, the proposed algorithm generates a series of feasible points that are not necessarily vertices. In particular, it is an interior point algorithm if the initial point used is interior. It terminates at an approximate optimal vertex, or at an exact optimal vertex if a simple purification is incorporated. Extensive computational experiments show that the algorithm are very efficient, relative to the standard simplex algorithm.

3 - A Method for Solving the General Parametric Linear Complementarity Problem
Marianthi G. Ierapetritou, Department of Chemical and Biochemical Engineering Rutgers -The State University of New Jersey, 98 Brett Road, Piscataway, 08854, United States of America, marianth@soemail.rutgers.edu, Zukui Li

We present a solution method for the general parametric Linear Complementarity Problem LCP(q,M), where q is affine function of uncertain parameters Œ∏ (q=d+FŒ∏). The method identifies how the minimum norm solution of the LCP depends on the value of the uncertain parameters in the given range through a multiparametric mixed integer linear programming algorithm. The proposed approach can address general matrix M and also the integer LCP where integrality restriction on the solution is applied.

■ SB52

H-Room 304, Third Floor

Rebates

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Qin Geng, Assistant Professor, Robert Morris University, 6001 University Boulevard, Moon Township, PA, 15108, United States of America, geng@rmu.edu

1 - Rebates in a Competitive Multichannel Market
Xiting Gong, PhD Candidate, Peking University, Department of Management Science, Bejing, China, gongxiting@gsm.pku.edu.cn, Gangshu Cai

Rebates have been popular in retailing. This paper investigates the optimal rebate strategies in a competitive circumstance where two supply chains are competing for a pool of customers. We compare models when either suppliers or retailers provide the rebates. We demonstrate that the suppliers prefer rebates more than the retailers do in some situations. It is shown that the rebate strategies are different from those in a single-channel supply chain.

2 - Using MSRP to Enhance the Ability of Rebates to Control Distribution Channels
Shilei Yang, Southwestern University of Finance and Economics, School of Business Administration, Chengdu, SC, 610074, China, syang@swufe.edu.cn, Chuck Munson, Bintong Chen

Manufacturers have increasingly instituted widespread rebate programs in recent years. However, retailers can counteract the power of rebates to impact demand by raising the retail price. We show that by combing a MSRP along with a rebate, the manufacturer can better control the channel by inhibiting the retailer's ability to raise price, particularly when consumers exhibit loss aversion. Incorporating MSRP with a rebate increases the manufacturer's profit, the channel profit and efficiency.

3 - Newsvendor Retailer's Mail-In Rebate
Qin Geng, Assistant Professor, Robert Morris University, 6001 University Boulevard, Moon Township, PA, 15108, United States of America, geng@rmu.edu, Suman Mallik

We examine mail-in rebates offered in a distribution channel consists of a single manufacturer and a single retailer within a newsvendor framework. We study two scenarios: only the retailer considers to offer rebate; and both the manufacturer and the retailer consider to offer rebate.We first study decision making under exogenous retail price.The models are extended to include endogenous retail price and rebate dependent redemption rate.

■ SB53

H-Room 305, Third Floor

IP Approaches for Optimization under Uncertainty

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, School of Industrial & Systems Engineeri, 765 Ferst Drive, Atlanta, GA, 30332, sahmed@isye.gatech.edu

1 - Strength of Mixed Integer Programming Formulations for Probabilistically Constrained Linear Programs
Juan Pablo Vielma, ISyE, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, jvielma@isye.gatech.edu, Shabbir Ahmed, George Nemhauser

We study the strength of different extended formulations for probabilistically constrained linear programs with right hand side uncertainty. In particular, we compare the relative strength between formulations that consider only one row at a time and formulations that consider two or more rows at a time. We also consider the effect of different assumptions on the distribution of the uncertain coefficients.

2 - On Mixing Sets and the Complexity of a Probabilistic Lot-sizing Problem
Simge Kucukyavuz, Ohio State University, Columbus, OH, 43202, United States of America, kucukyavuz.2@osu.edu

We consider a probabilistic lot-sizing problem with service level constraints and a finite discrete demand distribution. Assuming that the planning horizon is fixed, we show that the problem is polynomially solvable, using compact mixing set and p-efficient point reformulations.

3 - Experimenting with Convex Lower Envelope of Submodular Functions
Alper Atamturk, Professor, UC Berkeley, 4175 Etcheverry Hall MC 1777, Berkeley, CA, 94720, United States of America, atamturk@berkeley.edu, Vishnu Narayanan

We give a new proof for convex lower envelope construction for a submodular function and present computational experiments on minimizing several specific submodular functions.

■ SB54

H-Room 306A, Third Floor

Recent Applications of Semidefinite Programming

Sponsor: Optimization/Networks
Sponsored Session

Chair: Anthony Man-Cho So, The Chinese Univ of Hong Kong, Department of SE&EM, Shatin, NT, Hong Kong - PRC, manchoso@se.cuhk.edu.hk

1 - Measurement Sparsification and Chordal Decomposition for Sensor Network Localization
Zhisu Zhu, Stanford University, 102 Hoskins Ct, Apt 419, Stanford, CA, 94305, United States of America, zhuzhisu@stanford.edu, Anthony Man-Cho So, Yinyu Ye

We consider sensor network localization or graph realization with sparse and local edge-distance measurements. We develop a necessary and sufficient condition on localizability of the graph using only O(n) edge-distance measurements, where n is the number of nodes. This is in contrast to the early known result of O(n^2) or complete edge-distance measurements. As a result, we develop a more efficient semidefinite programming (SDP) method based on edge sparsification and clique decomposition.

2 - Integrality Gaps for Strong SDP Relaxations of Unique Games
David Steurer, Student, Princeton University, 35 Olden St, Princeton, NJ, 08540, United States of America, dsteurer@cs.princeton.edu, Prasad Raghavendra

We obtain the first integrality gaps for certain strong SDP relaxations of Unique-Games. For instance, we prove that after any number of rounds of Sherali-Adams lift-and-project a large gap remains. As consequence of this work, any number of rounds of Sherali-Adams lift-and-project does not improve the approximation ratio of the standard SDP for a variety of problems, e.g., Max-Cut, Max-3SAT, Multiway-Cut, and Maximum-Acyclic-Subgraph. We also obtain new SDP integrality gaps for Sparsest-Cut.

3 - Probabilistic Analysis of SDP Relaxations, with Application to MIMO Detection

Anthony Man-Cho So, The Chinese Univ of Hong Kong, Department of SE&EM, Shatin, NT, Hong Kong - PRC, manchoso@se.cuhk.edu.hk

One of the fundamental problems in modern digital communication is the detection of symbols in a MIMO channel. It can be approximately solved using SDP. Simulations have shown that such a heuristic has excellent empirical performance. However, its theoretical properties are still not well understood. In this talk we will introduce a general approach for analyzing the approximation guarantee of the SDP heuristic and give justification for its use in practice.

■ SB55

H-Room 306B, Third Floor

Models for Complex Networks

Sponsor: Optimization/Networks
Sponsored Session

Chair: Milena Mihail, Professor, Georgia Institute of Technology, 2138 Klaus Advanced Computing Building, 266 Ferst Drive, Atlanta, GA, 30332, United States of America, mihail@cc.gatech.edu

1 - Convergence of Network Dynamics

Amin Saberi, Professor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

Specific network structures have been shown to have dramatic influence on the convergence of network dynamics. In this talk, we make these results precise, and distinguish between probabilistic and game theoretic dynamics.

2 - Community Structure in Large Social and Information Networks

Michael Mahoney, Department of Mathematics, Stanford University, Stanford, CA, 94305, United States of America, mmahoney@cs.stanford.edu

We have performed a large scale analysis of a wide range of information networks. Our results suggest a different picture of community structure than has been assumed previously. We found that, at larger scales, the best possible communities gradually "blend in" with the rest of the network. This behavior is not explained by any of the commonly-used network generation models.

3 - Inner Product Graphs as Models for Complex Networks

Stephen Young, Post Doctoral Fellow, Georgia Institute of Technology, Klaus Advanced Computing Building, 266 Ferst Drive, Atlanta, GA, 30332, United States of America, young@math.gatech.edu

Inner Product Graphs generalize Erdos-Renyi graphs by endowing network nodes with attributes and determining network links according to inner products (and more general kernel functions). We characterize the structure of these graphs, including degree distribution, diameter, clustering and conductance.

■ SB56

H-Room 307, Third Floor

Optimization Applications in the Natural Gas Industry

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Kevin Furman, ExxonMobil, 3120 Buffalo Speedway, URC-URC-C328, Houston, TX, 77098, United States of America, kevin.c.furman@exxonmobil.com

1 - Parallelizing the GassOpt-Model

Peter Schutz, SINTEF Technology & Society, S.P. Andersens vei 5, Trondheim, Norway, peter.schutz@sintef.no, Lars Hellemo

The GassOpt-model is a mixed-integer program intended to maximize the flow of natural gas from the gas fields in the North Sea to the European customers. The problem is formulated as a multi-commodity network flow problem with pooling constraints in some of the nodes. These pooling constraints increase the complexity, and thus the solution time, of the problem considerably. We discuss our approach to solving the problem by decomposition and parallelization of the solution method.

2 - Risk Management Models of Natural Gas Contracts Portfolio Optimization for Gas Power Plants

Qipeng Zheng, PhD Student, University of Florida, Department ISE, Weil 303, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, zqp@ufl.edu, Panos Pardalos

In order to improve efficiency and release less green house gases while meeting the surge of the global energy demands, more and more power plants have started using natural gas as its energy source. In this talk, risk management models for the natural gas power plants are discussed. These models try to maximize the profit of the power plant while controlling the risks by optimizing gas contracts portfolios, and are solved by Embedded Benders Decomposition proposed by the authors.

3 - Development Planning of Natural Gas Transmission Pipeline Networks

Alireza Kabirian, Assistant Professor, University of Alaska-Anchorage, College of Business and Public Policy, 3211 Providence Drive, Anchorage, AK, 99508-4614, United States of America, a_kabirian@yahoo.com

The development planning of an existing natural gas transmission pipeline network is modeled as a nonlinear mixed integer optimization problem. In this model, the type, location, and installation schedule of major physical components of a network including pipelines and compressor stations are decided upon over a planning horizon with least cost goal and subject to network constraints. A heuristic optimization method is developed to solve the problem and a case study is used to show application.

■ SB57

H-Room 308, Third Floor

Optimization in Radiotherapy I

Sponsor: Health Applications
Sponsored Session

Chair: Robert Meyer, Professor Emeritus, University of Wisconsin-Madison, Madison, WI, United States of America, rrm@cs.wisc.edu

1 - A Set-cover Approach to Beam Orientation Optimization In Total Marrow Irradiation Using IMRT

Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca, Chieh-Hsiu Lee, Michael Sharpe

Selecting beams in site-specific intensity modulated radiation therapy (IMRT) treatment optimization is difficult; beam orientation optimization (BOO) for total marrow irradiation (TMI) using IMRT is even more complex. Because of the difficulty in designing treatments, TMI is not used with IMRT in practice. We propose formulating the BOO problem as a set-cover problem, and then apply set-cover heuristics to select beams. Our approach is fast and yields quality TMI treatment plans.

2 - A Two-stage Approach to IMRT Dose Optimization

Warren D'Souza, Associate Professor, University of Maryland, School of Medicine, Baltimore, MD, wdsou001@umaryland.edu, Robert Meyer, Hao Zhang

We present a two-stage approach to IMRT dose optimization based on (1)a fast Monte-Carlo-based aperture dose calculation (using apertures obtained via a conventional method) combined with (2) an IMRT dose optimization approach that uses sequential linear programming (SLP) to handle very large LP models. Results are presented for three challenging clinical test cases and contrasted with alternative approaches for IMRT dose optimization.

3 - A Network Approach for Intensity Modulated Arc Therapy (IMAT)

Athula Gunawardena, Associate Professor, University of Wisconsin-Whitewater, 800 West Main Street, Whitewater, United States of America, athula@cs.wisc.edu, Michael Ferris, Robert Meyer

We present an effective algorithm using network models for optimizing the delivery of Intensity Modulated Arc Therapy (IMAT).

4 - Minimum Knowledge Base for Predicting Organ-at-Risk Dose-Volume Levels and Complications

Hao Zhang, University of Maryland, 6802 Harrowdale Road, Baltimore, MD, 21209, United States of America, hzhan001@umaryland.edu, Warren D'Souza, Robert Meyer, Leyuan Shi

We present an approach for determining the minimum number of treatment plans required to build accurate representations of the intensity-modulated radiation therapy plan surface in order to predict organ-at-risk dose-volume (DV) levels and complications as a function of input DV constraint settings. Machine Learning algorithms embedded within a multi-plan framework were used for modeling and prediction.

■ SB58

H-Room 309, Third Floor

Contemporary Scheduling

Cluster: Scheduling
Invited Session

Chair: Joseph Leung, Distinguished Professor, New Jersey Institute of Technology, Department of Computer Science, Newark, NJ, 07102, United States of America, leung@oak.njit.edu

1 - Makespan Minimization with Machine Availability
Hairong Zhao, Assistant Professor, Purdue University Calumet, Department of Math., C.S., and Statistics, Hammond, IN, 46323, United States of America, hairong@calumet.purdue.edu, Bin Fu, Yumei Huo

We study makespan minimization problems with constant number of parallel machines under two availability models: the preventive model where the unavailability is due to maintenance and the fixed job model where the unavailability is due to a priori assignment of some fixed jobs. Assuming jobs are resumable, we design an FPTAS for fixed job model, a PTAS if one machine is always available and an approximation algorithm when all machines have unavailable intervals for the preventive model.

2 - Online Scheduling on Uniform Machines Subject to Eligibility Constraints
Kangbok Lee, Postdoc, New York University, Department Information, Operation and Management, 44 W. 4th St., New York, NY, 10012, United States of America, klee3@stern.nyu.edu, Michael L. Pinedo, Joseph Y-T Leung

We consider two models of online scheduling problem minimizing the makespan on uniform machines subject to eligibility constraints. Two models assume that 1) jobs arrive in a list and 2) jobs arrive over time, respectively. We provide lower bounds examples and algorithms with upper bounds under various scenarios on eligibility constraints and processing time.

3 - Parallel Machine Scheduling with Nested Processing Set Restrictions
Yumei Huo, Assistant Professor, CUNY at Staten Island, Department of Computer Science, Staten Island, NY, 10314, United States of America, yumei.huo@csi.cuny.edu, Joseph Leung

We consider the problem of scheduling a set of n jobs on m machines, where each job can only be scheduled on a subset of machines called its machine interval. The machine intervals are nested. Preemption is not allowed. Our goal is to minimize the makespan. We give an algorithm with a worst-case ratio of 7/4, which is an improvement over the best known algorithm with a worst-case ratio of 2-1/m. For two and three machines, the algorithm gives a worst-case ratio of 5/4 and 3/2, respectively.

4 - A Game of Competitive Investment: Over-capacity and Under-learning
Jian Yang, Associate Professor, New Jersey Institute of Technology, 323 Martin Luther King Jr Blvd, Newark, NJ, 07102, United States of America, jian.yang@njit.edu, Yusen Xia

We let firms decide individual investment levels. The sum of these levels determines the total return, which the firms share in proportions to their contributions. Firms may spend to learn the return function. Using this model, we can explain the over-capacity phenonenon that appeared from PC manufacturing to mortgage lending. The model involving competitive learning also sheds light on the chronical neglect of due diligence when companies need to conduct demand-forecast studies.

■ SB59

H-Room 310, Third Floor

Teaching Process Modeling Using IBM Software

Cluster: Tutorials
Invited Session

Chair: Rick So, Professor, UCI, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, rso@uci.edu

Co-Chair: Sharon McFadden, Program Manager, IBM Academic Initiative, slmcfadd@us.ibm.com

1 - Teaching Process Modeling Using IBM Software
Rick So, Professor, UCI, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, rso@uci.edu, Sharon McFadden, Neil Sahota

In this tutorial, we share our approach and experience in teaching a process modeling class using the IBM Websphere Business Modeler. The class was offered to a group of about 15 MBA students. Through industry practitioners and deploying the IBM commercial software, the students gain hands-on experience in analyzing and improving business process performance through process mapping and simulation. Specific support to class activities provided by IBM Academic Initiatives will also be discussed.

■ SB60

H-Room 311, Third Floor

Gradient Algorithms for Large Scale Convex Optimization

Cluster: Large Scale Optimization (In Honor of Jean-Louis Goffin)
Invited Session

Chair: Peter Richtarik, University of Edinburgh, James Clerk Maxwell Building, The King's Buildings, Edinburgh, EH9 3JZ, United Kingdom, peter.richtarik@uclouvain.be

1 - Primal-Dual Gradient Methods for Structured Convex Problems
Peter Richtarik, University of Edinburgh, James Clerk Maxwell Building, The King's Buildings, Edinburgh, EH9 3JZ, United Kingdom, peter.richtarik@uclouvain.be, Yurii Nesterov

In this work we develop and analyze an algorithm for minimizing a linear function over a simple convex compact set intersected with an affine subspace. We construct a primal-dual convex reformulation of the original problem with optimal value zero and analyze new gradient methods for minimizing convex functions with known optimal value. A special case of our algorithm is the subgradient method at one extreme and the level method at the other.

2 - Approximate and Restarted Estimate Sequences Schemes
Michel Baes, ETH, IFOR, Ramistrasse 101, Zurich, 8092, Switzerland, michel.baes@ifor.math.ethz.ch

Estimate sequences are provably the fastest gradient method for smooth convex problems. At every iteration, one must compute the objective gradient and solve two optimization problems. We determine how accurately those computations have to be done to avoid error propagations. Several variants of estimate sequence schemes will also be analyzed, including different restarting strategies.

3 - AdaBoost - Nothing Else Than a Mirror Descent Algorithm?
Michael Buergisser, ETH, IFOR, Ramistrasse 101, Zurich, 8092, Switzerland, michael.buergisser@ifor.math.ethz.ch, Michel Baes

Freund and Schapire introduced AdaBoost, a standard scheme in Machine Learning, in the late nineties. Mirror descent methods are due to Nemirovski and Yudin and belong to the class of subgradient schemes. We show that AdaBoost coincides with a well-chosen mirror descent algorithm. For this, we define an appropriate objective function and interpet AdaBoost's weak learner as an oracle providing approximate stochastic subgradients.

■ SB61

H-Room 312, Third Floor

Stochastic Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5E 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - A Production-inventory-location System with a Manufacturer and Multiple Demand Sources
Hossein Abouee Mehrizi, Rotman School of Management, 105 St. George Street, Toronto, Canada, H.AbooeeMehrizi07@Rotman.Utoronto.Ca, Oded Berman, Hasan Shavandi, Ata Zare

We analyze a production-inventory-location system problem where a manufacturer is to be established to satisfy the demand of retailers for a single product through distribution centers. The manufacturer and DCs may hold inventory in anticipation of future demand. If demand cannot be immediately satisfied from DC's inventory, it is backordered. We present an upper and lower bound for the optimal base stock levels, and an algorithm for determining the optimal location of manufacturer and DCs.

2 - Relocating Coverage Providing Facilities under Travel Time Uncertainty
Iman Hajizadeh, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, iman@rotman.utoronto.ca, Oded Berman, Dmitry Krass

A multi-objective maximum covering problem on a network with travel time uncertainty is analyzed with the objective of minimizing the number of facility relocations while ensuring adequate coverage under all travel time scenarios. A variety of model formulations are explored and compared. Exact and heuristic algorithms are presented.

3 - Minmax Regret Location for the Gradual Covering Problem on a Network with Uncertain Node Weights

Jiamin Wang, Associate Professor, Long Island University, Roth Hall 202, 720 Northern Blvd, Brookville, 11548, United States of America, Jiamin.Wang@liu.edu, Oded Berman

The gradual covering location problem seeks establishing facilities so as to maximize the total number of customers covered in the presence of partial coverage. This study considers finding the 'minmax regret' location that minimizes the worst-case coverage loss due to a decision made with an interval estimate being the only information available on the number of customers at each node. Polynomial time algorithms are respectively developed for the problem on a general network and a tree network.

4 - Location Models for Emergency Servers with Two Demand Classes

Seokjin Kim, Sawyer Business School, Suffolk University, 8 Ashburton Place, Boston, MA, 02108, United States of America, kim@suffolk.edu, Opher Baron, Oded Berman, Dmitry Krass

We propose location models for emergency servers with two demand classes of high priority and low priority. The problem is to minimize the number of servers on a network while achieving at least required service levels for the two classes. Exponential demand arrival times are specific to nodes and also classes. Servers stationed at nodes provide non-preemptive service in an exponential time within a pre-specified coverage radius.

■ SB62

H-Room 313, Third Floor

Experimental Studies on Sales and Channel Contracts

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Tony Cui, University of Minnesota, 321 19th Ave S, Suite 3-150, Minneapolis, MN, 55455, United States of America, tcui@umn.edu

1 - Tiers in One-sided Matching Markets

Yu Wang, Assistant Professor of Marketing, University of Texas at Dallas, 800 West Campbell Rd., SM32, Richardson, TX, 75080, United States of America, yuwang@utdallas.edu, Ernan Haruvy

The practice of shared ownership (with exchange options) has become increasingly popular in the luxury goods market. We demonstrate, both theoretically and experimentally, how a tiered structure in this one-sided matching market can allow firms to maintain both consumers' incentive to purchase high quality products in the primary sales market and their incentive to participate in the secondary matching market.

2 - Social Loss Aversion and Contest Deisgn

Noah Lim, University of Houston, 336 Melcher Hall, Houston, TX, 77204, United States of America, noahlim@uh.edu

We present a behavioral economics model to formalize the idea that changing the proportion of winners in a contest can alter the reference points that contestants use to make social comparisons. We show that a contest with a higher proportion of winners than losers can yield greater effort than one with fewer winners than losers if the degree of social loss aversion is sufficiently strong. We use two experiments validate this prediction.

3 - Quantal Response Equilibrium in Channel

Tony Cui, University of Minnesota, 321 19th Ave S, Suite 3-150, Minneapolis, MN, 55455, United States of America, tcui@umn.edu, Paola Mallucci

Cui, Raju, and Zhang (2007) analytically show that concerns of fairness in a dyadic channel could effectively alleviate double-marginalization. In this paper, we setup a Quantal Response Equilibrium model to analyze subjects behaviors in such a setting. We are interested in 1). How channel members make pricing decisions; 2). Do subjects show any concerns of fairness; and 3). What are subjects' weights associated with fairness relative to pecuniary payoff.

■ SB63

H-Room 314, Third Floor

Joint Session OR Bio/HAS: Public Health and Operations Research

Cluster: OR in Biomedicine and Global Health & Health Applications
Invited Session

Chair: Joseph Wu, Assistant Professor, University of Hong Kong, 21 Sassoon Rd, Pokfulam, Department of Community Medicine, Hong Kong, Hong Kong - PRC, joewu@hku.hk

1 - Population Screening and Protection in Response to Radiological Events

Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

State/local public health officials and emergency response personnel are responsible for planning and preparing for radiological incidents. Population monitoring plans must be in placed to improve current state/local agencies' capabilities and response logistics. In this talk, we describe the design of community reception center, efficient staffing, and training of key personnel to familiarize with the procedures. This work is joint with Dr. Ansari and Mr.Casper at CDC.

2 - A Dynamic Model for Post-traumatic Stress Disorder Among U.S. Troops in Operation Iraqi Freedom

Michael Atkinson, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, mpatkins@nps.edu, Adam Guetz, Lawrence Wein

We develop a model to predict how many troops will develop PTSD during Operation Iraqi Freedom (OIF). First we estimate troop deployment schedules. In the second part of the model we assume servicemembers incur a random amount of combat stress during each month of deployment, develop PTSD if their cumulative stress exceeds a servicemember-specific threshold, and then manifest symptoms for PTSD after an additional time lag. After calibrating the model we analyze how many troops may develop PTSD.

3 - Potential Benefits of a Population-wide Passive Immunotherapy Program during an Influenza Pandemic

Joseph Wu, Assistant Professor, University of Hong Kong, 21 Sassoon Rd, Pokfulam, Department of Community Medicine, Hong Kong, Hong Kong - PRC, joewu@hku.hk

Influenza pandemic preparedness and response planning has mainly focused on vaccines, antivirals and non-pharmaceutical interventions such as wearing of face masks, hand hygiene, household-based quarantine, school closure and other social distancing measures. In comparison, passive immunotherapy has received limited attention. We use a math model to explore the potential benefits of a population-wide passive immunotherapy program.

■ SB64

H-Room 202A, Second Floor

Panel Discussion: Teaching the Art of Modeling

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: James Orlin, Professor, MIT, E53-363, Cambridge, Ma, 02139, United States of America, jorlin@MIT.EDU

1 - Can Modeling be Taught?

Moderator: James Orlin, Professor, MIT, E53-363, Cambridge, MA, 02139, United States of America, jorlin@MIT.EDU, Panelists: Stephen Powell, Robert Shumsky

Modeling unstructured problems is fundamental to OR/MS, but many believe it is an art that cannot be taught. We believe that it can be taught, especially if one begins with an understanding of how novices approach such a modeling task. We discuss recent research on the modeling process. We then demonstrate some of the tools we use to teach this type of modeling by tackling a new problem we have not seen before live in front of the audience. Bring pen and paper and expect to be involved!

■ SB75

C-Room 32A, Upper Level

Planning Models for Rail Transportation

Sponsor: Railroad Applications
Sponsored Session

Chair: Teodor Crainic, CIRRELT-UQAM, C.P. 6128, succursale Centre-ville, Montreal, QC, H3C 3J7, Canada, theo@crt.umontreal.ca

1 - Scheduled Service Network Design for Rail Carriers

Endong Zhu, CIRRELT / Université de Montréal, Canada, endong@crt.umontreal.ca, Teodor Crainic, Michel Gendreau

Service network design aims to produce a good operating plan for railways. We integrate the essential operations at the tactical level into one compound model in order to generate the scheduled service design, blocking policy, train make-up policy and traffic distribution simultaneously. A slope scaling heuristic with long-term memory perturbation is developed and preliminary results on random instances show the proposed algorithm is efficient to find good feasible solutions.

2 - Minimizing Greenhouse Gas Emissions in Intermodal Freight Transport: An Application to Rail

Tolga Bektas, Dr, University of Southampton, Southampton, SO171BJ, United Kingdom, T.Bektas@soton.ac.uk, Teodor Crainic, Joanna Bauer

This paper addresses the issue of incorporating environment-related costs (greenhouse gases, to be specific) into freight transportation planning and proposes an integer program in the form of a linear cost, multicommodity, capacitated network design formulation that minimizes the amount of greenhouse gas emissions of transportation activities. Computational results based on an application of the proposed approach on a real-life rail freight transportation network are presented.

3 - Blocking Studies at CSX Transportation

Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com, Dharma Acharya, Ravindra Ahuja

Earlier this year, CSX performed very thorough studies related to optimizing its blocking plan, downgrading and closing its system yards, and capacity expansion of yards. These studies gave us valuable insights into the impact of yard locations and yard capacities on railcar handlings and car miles. In this presentation, we will share our insights with the audience.

4 - Managing Locomotives in Freight Rail Transportation Systems

Mervat Chouman, CIRRELT-UQAM, C.P. 6128, Succursale Centre-ville, Montreal, Qc, H3C 3J7, Canada, mervat@crt.umontreal.ca, Teodor Crainic

The problem concerns the planning of locomotive fleet management for a freight rail carrier. It consists in assigning a set of heterogeneous locomotives to scheduled trains, such that all trains have the required power during their entire journey, while a number of restrictions are satisfied. We present an integer formulation and propose a heuristic approach to obtain high-quality solutions.

Sunday, 1:30pm - 3:00pm

■ SC01

C-Room 21, Upper Level

Strategy & Risk Management

Sponsor: Decision Analysis
Sponsored Session

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

1 - Decision Analysis in Enterprise Risk Management

Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

Most professionals in the risk management community come from different disciplines than decision analysis. As ERM has grown to getting significant board and c-level attention it has begun addressing strategic decision problems without the frame and tools of DA. For the DA professional, this represents a major new market opportunity.

2 - Evaluating the Impact of Project Risk Analysis at ConocoPhillips

John Lehman, Risk Specialist, ConocoPhillips, 600 N. Dairy Ashford, Houston, TX, 77079, United States of America, john.lehman@conocophillips.com

After several years of formalized project risk analysis on capital projects ranging in size from the tens of millions to the trillions of dollars, ConocoPhillips has gathered enough history to begin to evaluate the impacts of risk analysis on its decision process. The paper will present the results of this evaluation. It will address common evaluation errors, bias in parameter estimation, sources of ambiguity and paths towards improved analysis and decision quality.

3 - Risk Models and Model Risks: A Decision-Making Perspective

Robert Stibolt, Managing Director, JP Morgan, bob.stibolt@stanfordalumni.org, Mazen Skaf

Over-reliance on models, over-simplifications and ignoring low probability events, and poor understanding of how to use analytic tools have contributed to risk management failures. We will review cases from the energy industry, commodity-intensive industries, and financial services and discuss lessons and principles from a decision-making perspective.

4 - Integrated Approach to Risk Management From Strategy to Operations

Mazen Skaf, Managing Director, Strategic Decisions Group, 745 Emerson St, Palo Alto, CA, 94301, United States of America, mskaf@sdg.com

The greatest risks that a business may face are strategic risks. Equally important in some cases, particularly in businesses exposed to highly volatile commodity and financial markets, are trading and operational risks. We present an integrated approach for risk management from strategy development and strategic investment decisions to managing operations. A case study will further illustrate the concepts, approach, process, and decision support systems.

■ SC02

C-Room 22, Upper Level

Value and Valuation: A Decision Analytic Approach

Sponsor: Decision Analysis
Sponsored Session

Chair: Ibrahim Almojel, Stanford University, P.O. Box 15348, Stanford, CA, 94309, United States of America, mojel@stanford.edu

Co-Chair: Somik Raha, Stanford University, Stanford, CA, 94309, United States of America, somik@stanford.edu

1 - Sources of Value

Somik Raha, Stanford University, Stanford, CA, 94309, United States of America, somik@stanford.edu

The Axiology literature makes a distinction between value and valuation. Valuation is the activity that helps us realize value. How do we then think about value? The Axiologist's value is not the same as the Decision Analyst's value. This talk will focus on Formal Axiology's Dimensions of Value and discuss its possible uses in Decision Analysis to identify sources of value.

2 - The Valuation of Multiplicative Fleeting Opportunities

Ibrahim Almojel, Stanford University, P.O. Box 15348, Stanford, CA, 94309, United States of America, mojel@stanford.edu, Jim Matheson, Pelin Canbolat

We study situations in which decision makers (DMs) with limited capacity have flows of independent fleeting deals coming over time. We formulate this problem as a dynamic program where the DM can accept directly, reject directly, or seek information and then decide whether to accept or reject. We characterize the optimal policy and the value of information over time and capacity. We assume DMs with multiplicative value functions and power utility.

3 - Valuing Conjugate Fleeting Opportunities

Muhammad Aldawood, Stanford University, Stanford, CA, 94309, United States of America, aldawood@stanford.edu, Ibrahim Almojel

In this paper we extend the problem of fleeting opportunities to include relevance between the deal types over time. The decision maker updates his/her belief as deals are offered over time. Specifically, we study priors belonging to families of conjugate probability distributions. We characterize the optimal policy and the value of information over the deals. Finally, we compare the results to the original fleeting opportunities setup with irrelevant deals.

4 - Valuing and Choosing Partners for an Investment

Laure Canis, Stanford University, 238 Ayrshire Farm Lane Apt 105, Stanford, CA, 94305, United States of America, laure.canis@polytechnique.org, Ibrahim Almojel

When choosing partners for an investment, individuals aim at forming a group whose interests are closest to theirs. We will characterize in terms of wealth and risk tolerance who are the best partners to associate with to maximize the value of the investment for each individual.

5 - Valuation of Fleeting Opportunities - Extensions

Pelin Canbolat, Stanford University, 228 Ayrshire Farm Lane # 203, Stanford, CA, 94305, United States of America, canbolat@stanford.edu

In a problem of fleeting opportunities, a decision maker with a limited capacity chooses between investing in a project with uncertain return or not. Such problems arise in the context of venture capital firms and recruitment processes. Certain assumptions ensure the optimality of a threshold policy, which is easy to compute and to implement. These assumptions include independence and unit capacity requirement of opportunities. This work studies the effects of relaxing these assumptions.

■ SC03

C-Room 23A, Upper Level

Economics of Social Networks

Cluster: Game Theory
Invited Session

Chair: Ilan Lobel, MIT, 77 Mass Ave, Cambridge, MA, United States of America, lobel@mit.edu

1 - Game Dynamics, Equilibrium Selection and Network Structure
Amin Saberi, Professor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

Coordination games describe social or economic interactions in which the adoption of a common strategy has payoff. They are classically used to model the spread of conventions, behaviors, and technologies in societies. Since the pioneering work of Ellison (1993), specific network structures have been shown to have dramatic influence on the convergence of such dynamics. In this talk, I will try to make these results more precise and use the intuition for designing effective algorithms.

2 - Communication Information Dynamics in (Endogenous) Social Networks
Kostas Bimpikis, PhD Candidate, MIT, 321 Haravrd Street, Apt. 202, Cambridge, MA, 02139, United States of America, kostasb@mit.edu, Daron Acemoglu, Asu Ozdaglar

We study a model of costly network formation, information aggregation through communication and decision making in large societies. We identify conditions under which there will be asymptotic learning, i.e., as the society grows, the fraction of agents taking correct actions converges to one. We identify properties of the communication cost structure that lead to topologies, that facilitate learning. Finally, we apply our results to random graph models, such as power law and Erdos-Renyi graphs.

3 - Optimal Network Seeding
Arun Sundararajan, NYU, 44 West 4th Street, New York, United States of America, asundara@stern.nyu.edu

I present a model of seeding with network effects that are "local": each agent is influenced by a (typically small and distinct) neighborhood of other agents rather than the entire population. I show that random seeding is almost always profit improving, provide conditions under which the optimal targeted seeding strategy targets the network's "fringes" (less connected nodes) in favor of the "hubsand discuss variation with underlying network structure, seeding costs and firm objectives.

4 - Non-Bayesian Social Learning
Alireza Tahbaz-Salehi, University of Pennsylvania, 3330 Walnut Street, Philadelphia, PA, 19104, United States of America, atahbaz@seas.upenn.edu, Ali Jadbabaie, Alvaro Sandroni

We propose a non-Bayesian model of opinion formation in a social network. The individuals in our model fail to incorporate their neighbors' information rationally. Instead, the belief of each individual is simply a convex combination of her Bayesian posterior and her neighbors' priors. We show that all individuals will asymptotically learn the true state of the world if the social network is strongly connected and their observations are independent.

■ SC05

C-Room 23C, Upper Level

Panel Discussion: Health Care in System Engineering: Past, Present, and Future Directions (Joint Session: QSR/HAS/Data Mining)

Sponsor: Quality, Statistics and Reliability, Health Appplications, & Data Mining
Sponsored Session

Chair: Jing Li, Assistant Professor, Arizona State University, Tempe, United States of America, jing.li.8@asu.edu

1 - Health Care in System Engineering: Past, Present, and Future Directions
Moderator: Jing Li, Assistant Professor, Arizona State University, Tempe, United States of America, jing.li.8@asu.edu, Panelists: George Runger, Andrew Schaefer, Ronald L. Rardin, James Benneyan, Kwok Tsui

The five panelists will share their views on the development and future of health care research in system and industrial engineering. Panelists: Drs. James Benneyan, Andrew Schaefer, Kwok Tsui, Ron Rardin, George Runger.

■ SC06

C-Room 24A, Upper Level

Journal of Quality Technology Invited Paper Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Dan Apley, Associate Professor, Northwestern University, Department of Industrial Engineering, Evanston, IL, 60208-3119, United States of America, apley@northwestern.edu

1 - A Review of Statistical Methods for Quality Improvement and Control in Nanotechnology
Jye-Chyi Lu, Professor, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, 30332-0205, United States of America, jclu@isye.gatech.edu

Nanotechnology has become a multidisciplinary subject with multiple research ventures in recent years. The use of statistical methods has aided the rapid development of nanotechnology in terms of data collection, treatment-effect estimation, hypothesis testing, and quality control. This paper reviews instances where statistical methods have been used in nanoscale applications such as experimental design, uncertainty modeling, process optimization and monitoring, and proposes future research.

2 - Bayes Inference for General Repairable Systems
Steven Rigdon, Southern Illinois University Edwardsville, Department of Mathematics and Statistics, Edwardsville, IL, 62026-1653, United States of America, srigdon@siue.edu, Rong Pan

Models for repairable systems are often characterized by the assumed effect of a failure and the subsequent repair. As-bad-as-old models lead to the nonhomogeneous Poisson process and as-good-as-new models lead to the renewal process. We study Bayesian methods for some models that are a compromise between the bad-as-old and the good-as-new models. For the case of multiple systems, we consider a hierarchical Bayes model.

■ SC07

C-Room 24B, Upper Level

Statistical Methods in Prognostics and Reliability

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi Gebraeel, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, nagi@isye.gatech.edu

1 - Classification of Defectives Products via a Pattern-based Model
Irad Ben-Gal, Associate Professor, Tel-Aviv University, Tel-Aviv University,Ramat Aviv,P.O. Box, Tel aviv, 69978, Israel, bengal@eng.tau.ac.il, Gonen Singer

In this work we propose a method for the classification of defectives products. In the first step, we find the profile for each type of defect based on a pattern-based model that represents the relations among attributes values that are inspected by sensors. In the second step, for each product defect, we obtain a likelihood grade representing its similarity relative to defects classes. Example based on a real dataset will be given.

2 - A Statistical Selection Procedure the Network Reliability Design Problem
Andrew Kiekhaefer, Graduate Research Assistant, University of Iowa, 248 ERF, Iowa City, IA, 52242, United States of America, akiekhae@engineering.uiowa.edu, Yong Chen

In this paper, we present a novel solution approach to the k-terminal network reliability design problem. This procedure selects the design with the highest reliability, given a user specified error rate, through the combination of statistical ranking and selection methods and Monte Carlo simulation.

3 - The Residual Life Distribution for Degradation Models under Time-varying Environment
Linkan Bian, Georgia Tech, 1065 Hampton St., Atlanta, United States of America, linkanbian@gatech.edu, Nagi Gebraeel

We present a stochastic model for characterizing degradation signals of components under time-varying environment, which affects a component's degradation rate. Our model is used to compute residual life using a first-passage time approach. This is achieved by combining population-based degradation characteristics with in-situ degradation signals, and real-time information of the environmental conditions. We validate this model by applying it to real world vibration-based degradation signals.

4 - Degradation Modeling of Complete,Sparse and Fragmented Degradation Signals

Rensheng Zhou, PhD Graduate Student, Georgia Tech, 1903 Drew Dr. NW Rm1202, Atlanta, United States of America, rzhou8@gatech.edu, Nagi Gebraeel, Nicoleta Serban

This paper presents a non-parametric degradation modeling framework for characterizing degradation signals of partially degraded engineering systems. We focus on modeling different types of degradation signals to predict the distribution of a system's residual life using real-time degradation signals. We consider complete signals, sparse signals and fragmented signals which are densely observed at disjoint time intervals. The approach is validated using degradation data of bearings.

■ SC08

C-Room 24C, Upper Level

Best Student Paper

Sponsor: Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu

1 - Multiple instance Learning via Margin Maximization

Erhun Kundakcioglu, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Building 2, Houston, TX, 77204, United States of America, erhun@ufl.edu, Onur Seref, Panos Pardalos

The classification problem within the multiple instance learning (MIL) context is considered. A combinatorial margin maximization problem for multiple instance classification is introduced and proven to be NP-hard. Computational results are presented for a branch and bound algorithm on publicly available image annotation and molecular activity prediction test cases.

2 - Dynamic Kernel-based Ridge Regression for Autocorrelations of Response Variables

Young-Seon Jeong, PhD Candidate, Rutgers, the State University of New Jersey, United States of America, ysjeong@eden.rutgers.edu, Norman Kim, Myong K. (MK) Jeong

We present a dynamic kernel ridge regression that combines kernel ridge regression with lagged dependent variables (LDVs) to improve the prediction accuracy when the dependent variables are autocorrelated and data are high-dimensional. Experimental results show that the proposed approaches with LDVs perform better than several conventional regression models.

3 - A Randomized Exhaustive Propositionalization Approach for Molecule Classification

Michele Samorani, Leeds School of Business - University of Colorado at Boulder, Bldg #4, UCB 419, Boulder, CO, 80309-0419, United States of America, michael.samorani@colorado.edu, Kirk DeLisle, Daniel Weaver, Manuel Laguna

Propositionalization is the process of generating attributes for observations whose characteristics are stored across the tables of a database. The resulting single table can be used as input for a classification procedure. We extend this approach by generating more expressive attributes and using randomization to sample a small set of complex attributes. We apply our method to molecule classification problems and show that the generated attributes are interpretable and lead to a better accuracy

4 - Mining Association Rules with Disjunctions in Consequents

Abhijeet Ghoshal, University of Texas, Dallas, TX, abhijeet.ghoshal@student.utdallas.edu, Sumit Sarkar

We have identified a kind of rules that would be more useful in making recommendations as compared to traditional rules when multiple items are being recommended. We have developed a novel mining algorithm to obtain such rules. Experiments show that the accuracies of recommendations made using the new rules are significantly higher than those made using conjunctive association rules.

■ SC09

C-Room 25A, Upper Level

Games of Fun and Strategy

Sponsor: Applied Probability
Sponsored Session

Chair: Eric Friedman, Cornell University, School of ORIE, Rhodes Hall, Ithaca, NY, 14853, United States of America, ejf27@cornell.edu

1 - Computer (and Human) Perfection at Checkers

Jonathan Schaeffer, University of Alberta, UHall 2-10, Edmonton, AB, T6G2J9, Canada, jonathan@cs.ualberta.ca

In 1989 the Chinook project began with the goal of winning the human World Checkers Championship. The champion, Marion Tinsley, was as close to perfection at the game as was humanly possible. To be better than Tinsley meant that the computer had to be perfect. In effect, one had to solve checkers. Little did we know that our quest would take 18 years to complete. In this talk, the creator of Chinook tells the story of the quest for computer and human perfection at the game of checkers.

2 - A Geometric Analysis of Nim with a Pass

Adam Landsberg, Associate Professor of Physics, Claremont McKenna, Pitzer, and Scripps Colleges, Joint Science Department, 925 N. Mills Ave, Claremont, CA, 91711, United States of America, alandsberg@jsd.claremont.edu, Rebecca Morrison, Eric Friedman

Nim is among the best known combinatorial games. A seemingly simple variant (proposed by the late David Gale) wherein a "pass" is introduced appears to radically increase the game's complexity. In this talk I describe a novel physics-inspired technique which yields probabilistic insights into deterministic combinatorial games based on their underlying geometry. Applying this to Nim-with-a-pass, I show how the increase in complexity is related to a change in the game's underlying geometry.

3 - Regret Minimization for Solving Large Imperfect Information Games

Michael Bowling, Associate Professor, University of Alberta, Department of Computing Science, Edmonton, AB, T5B2Y5, Canada, bowling@cs.ualberta.ca

We examine the use of regret minimization for computing equilibria in large extensive games. We review the concept of counterfactual regret, and show how sampling can dramatically reduce convergence times of these methods. The resulting algorithms essentially compute an equilibrium by simply playing the game. We show its effectiveness in poker, where it was a key part of Polaris, the first computer poker program to defeat pro players. We also demonstrate it on a diversity of non-poker games.

4 - It's Not Your Imagination, Monopoly Never Ends...

Shane Henderson, Professor, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Eric Friedman

... with positive probability. We estimate the probability that two players playing the board game Monopoly will slug it out forever, i.e., that neither player will bankrupt the other. This probability certainly depends on the player's strategies. We assume specific "reasonable" strategies. We'll explain the different estimation methods we used and provide our probability estimate.

■ SC10

C-Room 25B, Upper Level

Stochastic Models of Market Microstructure

Sponsor: Applied Probability
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, United States of America, c.maglaras@columbia.edu

Co-Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

1 - Stochastic Modeling of a Limit Order Book

Rama Cont, Associate Professor, Columbia University, 500 W. 120th Street, New York, NY, 10027, Rama.Cont@columbia.edu, Rishi Talreja, Sasha Stoikov

The high-frequency dynamics of a limit order book can be described in terms of a queuing system with interesting features. This analogy leads to allows to simulation-free computation of various probabilities, conditional on the state of the order book: an increase in the mid-price, execution of an order at the bid before the ask quote moves, and execution of both a buy and a sell order at the best quotes before the price moves.

2 - The Value of Latency

Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Mehmet Salgram

Modern electronic markets have been characterized by a relentless drive towards faster decision making. Significant technological investment have lead to dramatic improvements in latency, or the delay between a trading decision and the resulting trade execution. We describe a model to that allows for the quantitative valuation of latency in trade execution. Our model is surprisingly simple and easy to interpret.

3 - A Multiclass Queueing Model of Limit Order Book Dynamics

Costis Maglaras, Columbia University Business School, 4I Uris Hall, 3022 Broadway, New York, NY, 10027, United States of America, cm479@columbia.edu, Ciamac Moallemi

We model the limit order book as system of two, coupled multiclass queues. Specifically, each side of the book is modeled as a single server, multiclass queue operating under a strict priority rule defined by the prices associated with each limit order. We describe the transient dynamics of this system, and formulate and solve the optimal execution problem for a block of shares over a short time horizon.

■ SC11

C-Room 25C, Upper Level

Port and Border Security

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Vicki M Bier, Professor, University of Wisconsin-Madison, Room3234 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu

1 - Deterring and Detecting the Smuggling of Nuclear Weapons in Container Freight

Naraphorn Haphuriwat, naraphoh@cae.wisc.edu, Henry H Willis, Vicki M Bier

Concerns about terrorists smuggling nuclear bombs into the U.S. in container freight have led to demands for 100% inspection at U.S. ports. However, under some circumstances, it is possible to deter smuggling attempts with less than 100% inspection. We quantify a model of inspection and deterrence to find the optimal level of inspection in the face of attempted nuclear smuggling, and explore the sensitivity of the model results to plausible changes in parameter values.

2 - Port Security Risk Management and Resource Allocation (PortSec)

Isaac Maya, Director of Research, USC/CREATE, 3710 McClintock Ave., RTH308, Los Angeles, CA, 90089-2902, United States of America, imaya@usc.edu, Anthony Barrett, Michael Orosz, Petros Ioannou, Onur Bakir

This study develops and applies systems-based risk management methodologies and tools for assessing tactical and strategic risk to port operations and evaluating alternative technology-based solutions and resource allocation policies. For tactical usage, PortSec will provide up-to-date risk information for areas of interest and the overall port complex. For strategic usage, PortSec will provide the port security analyst with tools to evaluate costs and benefits of counter-measures.

3 - Novel Inspection Policies to Prevent Nuclear Materials Smuggling

Gary Gaukler, TAMU, TAMU-3131, College Station, United States of America, gaukler@tamu.edu, Alex Vaughn, Michelle McGaha, Yu Ding, Chenhua Li

We propose a layered container inspection system for detecting illicit nuclear materials using radiography information. We argue that the current inspection system, relying heavily on the Automated Targeting System (ATS) and passive radiation detectors, is inherently incapable of reliably detecting shielded radiative materials. This motivates the development of a new inspection system, allowing for improved defense against sophisticated adversaries.

4 - Estimating the Operational Impact of Container Inspections at International Ports

Nitin Bakshi, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nbakshi@london.edu, Stephen Flynn, Noah Gans

A recent US law mandating non-intrusive imaging and radiation detection for 100% of US-bound containers at international ports has provoked widespread concern that the resulting congestion would hinder trade significantly. Using detailed data on container movements, gathered from two large international terminals, we simulate the impact of various inspection policies being considered.

■ SC12

C-Room 26A, Upper Level

ICS Prize Winners

Sponsor: Computing Society
Sponsored Session

Chair: S. Raghavan, Associate Professor, University of Maryland, University of Maryland, College Park, MD, United States of America, raghavan@umd.edu

1 - ICS Prize Session

The winners of the 2009 ICS Prize and the 2009 ICS Student Paper Award present their award-winning work.

2 - An Interior-Point Filter Line-Search Algorithm for Large-Scale Nonlinear Programming

Andreas Wachter, PhD, IBM T.J. Watson Research Center, Department of Mathematical Sciences, P.O. Box 218, Yorktown Heights, NY, 10598, andreasw@watson.ibm.com, Lorenz Biegler

We present an algorithm for large-scale nonlinear continuous optimization, together with real-life applications, such as the tuning of transistors in digital circuits, modeling and design of chemical processes and optimal control of nonlinear dynamic systems. We will also present some recent developments of the algorithm, including parametric sensitivity of NLP solutions and the use of iterative linear solvers. An implementation of this algorithm ("Ipopt") is available as open source.

3 - A Line Search Multigrid Method for Large-Scale Nonlinear Optimization

Zaiwen Wen, NSF Math Institutes Postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Donald Goldfarb

We present a line search multigrid method for solving discretized versions of general unconstrained infinite dimensional optimization problems. At each iteration on each level, the algorithm computes either a 'direct search' direction on the current level or a 'recursive search' direction from coarser level models. Introducing a new condition that must be satisfied by a backtracking line search procedure, the 'recursive search' direction is guaranteed to be a descent direction. Global convergence is proved under fairly minimal requirements on the minimization method used at all grid levels. Using a limited memory BFGS quasi- Newton method to produce the 'direct search' direction, preliminary numerical experiments show that our line search multigrid approach is promising.

■ SC14

C-Room 27A, Upper Level

Network Applications

Sponsor: Computing Society
Sponsored Session

Chair: Douglas Shier, Professor, Clemson University, Mathematical Sciences Department, Clemson, SC, 29634, United States of America, shierd@clemson.edu

1 - A Biased Random-keys Genetic Algorithm for Monitor Placement in Telecom Networks

Mauricio G. C. Resende, Lead Member of Technical Staff - Research, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com

We present a biased random-keys genetic algorithm (BRKGA) for placing monitors on edge routers in a telecommunications network. These monitors are used to measure customer traffic performance between edges routers. A trivial solution places a monitor at each edge router. The solutions produced by the BRKGA allow very few monitors to be used.

2 - Scheduling First-Year Seminars

Kevin Hutson, Associate Professor, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, kevin.hutson@furman.edu

First-year seminars are designed to help students adjust to college-level material and work load. At some colleges, the seminar is broken into two courses, a seminar-type course and a writing-intensive course. At Furman, incoming students are required to take one of each of these course in their first two terms. Here we discuss algorithms for scheduling students to seminars and the problem of determining how many preference choices to give students for scheduling purposes.

3 - An Optimization Approach to a Geometric Packing Problem
Douglas Shier, Professor, Clemson University, Mathematical Sciences Department, Clemson, SC, 29634, United States of America, shierd@clemson.edu, Brad Paynter

We investigate a geometric packing problem derived from an industrial setting that involves the fitting of patterns of circles without overlap. We model this as a feasibility problem and provide a useful theoretical characterization, leading to shortest path subproblems linked to integer solutions of systems of inequalities. These inequalities can be explicitly solved for small dimensions, but in general require integer programming techniques. Directions for future development are discussed.

■ SC15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Vanguard Software
Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Vanguard System solves a fundamental challenge of professional modeling groups ñ enabling stakeholders to interact with your models without requiring them to be modeling experts or to have licenses of your modeling software. See how Vanguard turns desktop models into interactive Web applications for forecasting, simulation, and optimization without Web programming!

2 - Gurobi Optimization - Hands on with the Gurobi Python Interactive Interface
Ed Rothberg, COO and Co-founder, Gurobi Optimization Inc., 3733-1 Westheimer Road, Houston, United States of America, rothberg@gurobi.com

Gurobi Optimization provides robust, high-performance optimization software based on the latest linear and mixed-integer programming technologies. Gurobi includes an impressive full-access, interactive interface written in Python. We will take an in depth look at the Gurobi Python interactive interface and how it can be used as a powerful, rapid prototyping tool.

■ SC16

C-Room 28A, Upper Level

Joint Session IS/eBusiness: Digital Platforms and Competitive Strategy

Sponsor: Information Systems & eBusiness
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, N231 BCC, East Lansing, MI, 48824, United States of America, sambamurthy@bus.msu.edu

1 - Online and Offline Demand and Price Elasticities: Evidence From the Air Travel Industry
Nelson Granados, Assistant Professor of Information Systems, Graziadio School of Business, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu, Alok Gupta, Robert Kauffman

We compare the demand functions in offline and online travel agency (OTA) channels, using a data set with millions of records or airline ticket sales in both offline and online channels. To our knowledge, this is the first study that compares demand functions in the two channels using massive sales data. We find that demand on the Internet is more price-elastic, driven by the OTA transparency levels and by a different mix of customers relative to the offline channel.

2 - Digital Systems, Network Structure and Competitive Actions
T. Ravichandran, Associate Professor, RPI, Lally School of Management, 110 Eighth Street, Troy, NY, 12180, United States of America, ravit@rpi.edu, Lei Chi, Goce Andrevski

In this study, we focus on two antecedents of competitive activity of firms: 1) access to network resources and 2) use of information technology. Our focus is on how firms use IT to exploit their external network resources for influencing firm competitive behavior and develop a theoretical model that examines the relationships between IT use, network structure, and competitive action. We test our model using secondary data collected from one industry over a period of 16 years.

3 - A Network Perspective of Digital Competition in Online Advertising Markets: A Simulation Approach
Wonseok Oh, Associate Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, wonseok.oh@mcgill.ca, Dowan Kwon, Ray Chang, Alain Pinsonneault

Based on agent-based simulations, we explore how influence networks play a synergy-creating role in the situation where non-market leaders form strategic alliances, either horizontal or vertical, to compete with a dominant leader. We also assess the extent to which targeting strategies and the timing of strategic actions affect alliance outcomes.

■ SC17

C-Room 28B, Upper Level

Ontology, Cognition and Semantics: Conceptualizing Meaning in Information Systems

Sponsor: Information Systems
Sponsored Session

Chair: Vijay Khatri, Associate Professor, Indiana University, 1309 E. 10th Street, BU 560F, Bloomington, IN, 47405, United States of America, vkhatri@indiana.edu

1 - Boundary Objects, Conceptual Models and Cognition: Engaging Users in Work Systems Improvements
Andrew Gemino, Associate Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, gemino@sfu.ca

System analysis researchers should study representation and the cognition of those who create and view representations. Experimental results suggest improved understanding can be facilitated through more effectively presenting system models and providing opportunity for interaction. Stakeholders benefit from these changes that make information from traditional analysis methods more accessible. Accessibility leads to higher levels of engagement and more understanding of work systems improvements.

2 - Ontological Rules in Conceptual Modeling: What and When
Andrew Burton-Jones, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, Andrew.Burton-Jones@sauder.ubc.ca, Palash Bera, Yair Wand

In the early stages of developing an information system, systems analysts often create conceptual models to document their understanding of the business domain to be supported by the system. Very few guidelines exist for creating conceptual models. This presentation will summarize a research program that aims to determine whether theories of ontology can provide guidelines for conceptual modeling. The presentation will focus on what such guidelines might be and when they will be most useful.

■ SC18

C-Room 28C, Upper Level

Computational Biology

Sponsor: Computing Society
Sponsored Session

Chair: Ezgi Eren, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, United States of America, ezgieren@neo.tamu.edu

1 - Branch-and-price in Column Generation with Nonlinear Subproblem for Sibling Reconstruction
Chun-An Chou, Department of Industrial and Systems Engineering, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, joechou@rci.rutgers.edu, Zhe Liang, Tanya Berger-Wolf, Mary Ashley, Bhaskar DasGupta, W. Art Chaovalitwongse, Saad Sheikh, Isabel Caballero

We propose a new branch-and-price in column generation for sibling reconstruction. The master problem is formulated as a set covering problem with multi-objective function, while the pricing subproblem is a quadratic program incorporating a likelihood function. We tested approaches on real data sets, and the results provide important insights in population biology.

2 - Systems Biology Based Drug Target Identification in Diabetes
Soundar Kumara, Professor, Industrial Engineering and Information Science Technology, 310 Leonhard, University park, PA, 16802, United States of America, u1o@engr.psu.edu, Manini Madireddy

In our study morbidly obese diabetic patients undergoing bariatric surgery were found to be freed from diabetes after the surgery. Our hypothesis that the differentially expressed proteins (before and after surgery) in the patients may be related to the potential drug targets for diabetes. We analyze the protein sample in the context of the entire human protein interaction network. Preliminary results indicate that the topological properties of sample proteins provide significant insights.

3 - Prior Knowledge Can Enhance Classification Accuracy of Biomedical Data
Altannar Chinchuluun, Dr., University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, altannar@ufl.edu, Stratos Pistikopoulos, Mario Guarracino

Neural Networks have proven to be a strong method to extract regularities in data and classify events. We propose a way to include knowledge into Radial Basis Function Neural Networks and to express knowledge as set of linear constraints to the underling least square problem. Publicly available biomedical datasets are used as case study to analyze the performance of the approach and to compare the results with state of the art classifiers.

4 - Stochastic Models for Microtubule Dynamics and Organization Inside the Plant Cell
Ezgi Eren, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, United States of America, ezgieren@neo.tamu.edu, Natarajan Gautam, Ram Dixit

In this research, we model stochastic growth and interactions of microtubules which are polymers found in living cells. In plant cells, microtubules are created in arbitrary locations on the cell wall and they grow, shrink and interact by running into one another, thereby changing their trajectories. However, these interactions lead to an organized structure which we use discrete and continuous Markov models to characterize. We test the results with computer simulations and lab experiments.

■ SC19

C-Room 28D, Upper Level

Advances in Network Equilibrium Models I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu

1 - A New Stochastic Traffic Equilibrium Model with Probabilistic Travel Times and Perception Errors
Zhong Zhou, Developer, Citilabs, 1040 Marina Village Pkwy, Alameda, CA, 94501, United States of America, zzhou@citilabs.com, Anthony Chen, William Lam Hing-keung

This study proposes a novel stochastic traffic equilibrium model that considers both reliability and unreliability aspects of travel time variability and perception errors within the travelers route choice decision processes. An approximation method based on moment analysis is developed to compute the perceived mean-excess travel time. The model is formulated as a variational inequality problem, and solved by a route-based algorithm with the use of the modified alternating direction method.

2 - An Improved Path-based Flow Update Algorithm for the Static User Equilibrium Traffic Assignment Problem
Amit Kumar, Research Assistant, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, kumar44@purdue.edu, Srinivas Peeta

We propose an improved algorithm to determine the path-based user equilibrium traffic assignment solution. The algorithm inherits some insights from the gradient projection algorithm of Jayakrishnan et al. (1994) and Florian et al. (2009), and extends the idea of Dial (2006) from a pair of paths to multiple paths. It applies separate flow update move directions for costlier and cheaper paths. The problem is formulated and solutions are presented for a test network.

3 - On the Existence of Dynamic User Equilibrium in a Stochastic Network with Adaptive Travelers
Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu

Traffic systems are inherently uncertain with random disturbances such as incidents and bad weather. Therefore travelers might adapt to traffic conditions revealed through traveler information systems, rather than following fixed routes. Conventional network equilibrium analysis does not take into account these factors. This research investigates the existence of dynamic user equilibrium in a stochastic network with adaptive travelers, which is formulated as a fixed point problem.

4 - Method of Isochronal Vehicle Assignment: Methodology, Computational Performance, and Self-Tuning
Eric Nava, The University of Arizona, 1209 E. 2nd St. Room 206, Tucson, AZ, 85719, United States of America, ejnava@email.arizona.edu, Yi-Chang Chiu

Method of Isochronal Vehicle Assignment is an innovative dynamic traffic assignment computational scheme that decouples the network loading and assignment procedure, making 24-hour DTA analysis possible. In this talk, we discuss the MIVA concept, methodology, computational performance, and the self-tuning approach for optimal performance setting.

■ SC20

C-Room 28E, Upper Level

Heuristics for Vehicle Routing Problems III

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: John Beasley, Professor, Brunel University, Mathematical Sciences, Uxbridge, UB8 3PH, United Kingdom, John.Beasley@brunel.ac.uk

1 - Metaheuristics for Orienteering Problems
Richard Hartl, Department of Business Administration, University of Vienna, Vienna, Austria, Richard.Hartl@univie.ac.at

In the orienteering problem not all customers must be visited and a maximum profit should be collected within a given travel time. Heuristic solution techniques based on variable neighborhood search are presented and competitive results for benchmark instances are provided. Also considered is a multi-objective problem variant as well as an application where customers have several alternative time windows.

2 - Column Generation Procedure for the Split Delivery Vehicle Routing Problem
Joe Wilck, Assistant Professor, The University of Tennessee (Knoxville), 411 East Stadium Hall, Knoxville, TN, United States of America, joe.wilck@gmail.com, Tom M. Cavalier

The Split Delivery Vehicle Routing Problem (SDVRP) allows customers to be assigned to multiple routes. A column generation procedure is developed for the SDVRP. Computational results are given for data sets from previous literature. With respect to the total travel distance and computation time, the column generation procedure compares favorably versus previously published methods.

3 - A Tabu Search Heuristic for the Waste Collection Vehicle Routing Problem with Time Windows
John Beasley, Professor, Brunel University, Mathematical Sciences, Uxbridge, UB8 3PH, United Kingdom, John.Beasley@brunel.ac.uk

We have a single depot, a set of waste disposal sites and a set of customers at which waste is collected. Vehicles go out from the depot and collect waste from customers, emptying themselves at the waste disposal sites as and when necessary. A nearest neighbour greedy technique is used to obtain an initial solution. We improve this solution using an approach based on neighbour sets, followed by a tabu search phase. Computational results are presented for problems involving up to 2100 customers.

■ SC21

C-Room 30B, Upper Level

Large-scale Planning and Analysis Models for Air Traffic Flow Management

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Robert Hoffman, Principal Analyst, Metron Aviation Inc., 45300 Catalina Court, Dulles, VA, 20166, United States of America, Hoffman@metronaviation.com

1 - Strategic Air Traffic Management with Dynamic Uncertain Weather
Andrew Churchill, Graduate Research Assistant, University of Maryland, Dept of Civil Engineering, 1173 Martin Hall, College Park, MD, 20742, United States of America, churchil@umd.edu, David Lovell

We consider the problem of routing many aircraft in the presence of uncertain dynamic weather disruptions. Such disruptions presents two challenges: the potential for blocking planned routes, as well as the uncertain nature of the movement and evolution of the disruption. Several variations of this problem are

presented, covering various levels and dimensions of stochasticity, as well as several different methodological approaches. The implications for daily strategic planning are discussed.

2 - Resource Allocation in FCA with Stochastic Termination Times Considering Optimistic Reroutes

Moein Ganji, Ph.D. Candidate, University of Maryland, Department of Civil and Environmental Eng., University of Maryland, College Park, md, 20740, United States of America, moein_g@yahoo.com

We formulate an optimization model for the assignment of dispositions to flights whose preferred flight plans pass through an FCA. The model is a two-stage stochastic program that represents the time of future capacity windfall as a random variable. This paper extends our earlier work on this problem by allowing the initial reroutes to vary from pessimistic to optimistic. We conduct experiments allowing a range of such trajectories and draw conclusions regarding appropriate strategies.

3 - Dantzig-Wolfe Decomposition Applied to National Traffic Flow Management

Joseph Rios, Aerospace Engineer, NASA, Mail Stop 210-10, Moffet Field, CA, 94035, United States of America, Joseph.L.Rios@nasa.gov, Kevin Ross

Scheduling traffic flows over the entire National Airspace System is a computationally intensive task. A job-shop scheduling based model for solving this problem is demonstrated to provide high-fidelity solutions in reasonable time through the application of Dantzig-Wolfe Decomposition. We show that by massively parallelizing by assigning a single flight to each subproblem, computation time and solution integrality properties both improve. Theoretical reasons for the results will be discussed.

4 - Lessons Learned From Running Large-scale Models: The Joy and Pain of it All!

Robert Hoffman, Principal Analyst, Metron Aviation Inc., 45300 Catalina Court, Dulles, VA, 20166, United States of America, Hoffman@metronaviation.com

We will discuss some of the complexities and nuances of implementing large-scale planning models on real-world data.

■ SC22

C-Room 30C, Upper Level

Joint Session Location Analyis/TSL: Location Models for Transportation Facilities

Sponsor: Location Analysis & Transportation Science and Logistics
Sponsored Session

Chair: Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B156, 205 N. Mathews Avenue, Civil & Environmental Engineering, Urbana, IL, 61801, United States of America, nourbak1@illinois.edu

1 - Multi-Modal Facility Location Methodology for Optimal Placement of Park and Ride Facilities

Jhael Isa, Graduate Student, Rensselaer Polytechnic Institute, 2441 22nd Street #5, Troy, NY, 12180, United States of America, isaj@rpi.edu, Satish Ukkusuri, Kien Doan

This work presents a mathematical programming approach to solve a multi-modal facility location problem to locate park-and-ride facilities. The formulation uses facility location techniques to perform the location of the park-and-ride facility. Practical considerations related to environmental objectives and land use agreements will be considered. The model is implemented in the New York City area to illustrate results.

2 - Optimal Fueling Schedule and Fuel Station Problem

Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B156, 205 N. Mathews Avenue, Civil & Environmental Engineering, Urbana, IL, 61801, United States of America, nourbak1@illinois.edu, Yanfeng Ouyang

This study proposes a mathematical model to minimize the total cost needed to fuel all locomotives travel over a railroad network. The given locomotive routes pass through multiple candidate gas stations that are available for contracting and offer different fuel prices. The goal of the model is to balance the trade-off between fuel purchase costs, the delay of the locomotives for fueling, and the contracting cost for the used fuel stations, while ensuring the locomotives never run out of fuel.

■ SC23

C-Room 30D, Upper Level

Methods for Technology Management

Sponsor: Military Applications Society
Sponsored Session

Chair: Ann-Marie Lamb, PhD Student, Engineering & Technology Management, Portland State University, Portland, United States of America, ajlamb@pdx.edu

1 - Optimal Design and Prepositioning of Humanitarian Assistance Pack-Up Kits

Wilson Price, Visiting Professor, Naval Postgraduate School, 1411 Cunningham Road, Monterey, Ca, 93943-5219, United States of America, wipr1@aol.com, Valerie McCall, Gerald Brown

Providing exigent humanitarian relief is a core mission of the U.S. military. We present a design for supply kits, each sufficient to support a thousand people for two weeks, and show how to preposition these kits for quick delivery to affected populations. We illustrate with a policy case study for US Pacific Command.

2 - Application of ANP Methodology in Evaluation of Advanced Manufacturng Technologies

Sharon Ordoobadi, University of Massachusetts-Dartmouth, 285 Old Westport Road, Dartmouth, MA, 02747, United States of America, sordoobadi@umassd.edu

Selection of a new technology is multidimensional in nature and interdependent relationships exist among various qualitative and quantitative elements of the system. Thus the Analytic Network Process (ANP) is used in the development of the proposed decision tool. Several pair-wise comparisons are conducted to determine local priorities for the selection criteria and alternatives. These priorities are then used to determine the overall priorities for rankings of the alternatives.

3 - Emerging Technology Forecasting Method Used for Strategic Technological Breakthroughs

Ann-Marie Lamb, PhD Student, Engineering & Technology Management, Portland State University, Portland, United States of America, ajlamb@pdx.edu, Timothy Anderson

Technology Forecasting Data Envelopment Analysis (TFDEA) is used to assist in predicting technology maturity as well as creating strategy for new product development and revolutionary technology breakthroughs; thereby enabling strategists to plan for(or even drive) technology frontiers. The latest TFDEA application will be shared.

■ SC24

C-Room 30E, Upper Level

Business Mission Area - ERPs

Sponsor: Military Applications Society
Sponsored Session

Chair: Tim Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, 422 Mahan Hall, West Point, NY, 10996, United States of America, timothy.elkins@usma.edu

1 - Building a Local Logistical Support System for Emergency Response and Disaster Recovery

Timothy Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, Room 422, Mahan Hall, West Point, NY, 10996, elkins.timothy@gmail.com, John Shaw, Carmine Centrella, Daniel Scace

The Region 3 Emergency Planning Team (Capitol Region of CT) required a system to acquire, inventory, deploy, track, and demobilize emergency response and recovery resources, including personnel. Collaborating with the Department of Systems Engineering at the United States Military Academy, the Team developed a decision analysis / support model to aid in the selection / design of a system to meet the region's needs using a values-driven, holistic approach, the Systems Decision Process.

2 - Achieving the Army Business Transformation via an ERP Center of Expertise

George Albinson, Director, ERP CoE, RDECOM, ARDEC, Bldg 1, Picatinny Arsenal, NJ, 07806-5000, george.albinson@us.army.mil

ARDEC is the first Federal winner of the Baldrige Award and implemented the SAP ERP application for its business requirements, achieving a cross-organization, cross-functional approach. Without adaptive capabilities through agile business processes, the Army Transformation cannot be achieved. Army leadership has formed a Center of Expertise supported by Process Teams. The ARDEC ERP will develop the ERP COE to converge and sustain Army ERP programs.

3 - Configuring an ERP for Army Enterprise Management
John Organek, Enterprise Architect, BMA, Office of the Deputy Undersecretary of the Army, ODUSA, Pentagon 3A514A, Washington, DC, 20310, United States of America, John.Organek@us.army.mil

The US Army has been converging its multiple, largely single-functioned, enterprise resource planning (ERP) software landscape to optimize the efficiency and effectiveness of its core business processes. The converged ERP is to be a key component of the Army's transformation to top-to-bottom enterprise management. The initial integration thread will focus on the processes, activities, and data required to support the Army Force Generation process (ARFORGEN).

■ SC25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Propagation of Flight Delay and Passenger Impacts I

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Cynthia Barnhart, Associate Dean for Academic Affairs, MIT, School of Engineering, Cambridge, MA, 02139, United States of America, cbarnhart@MIT.EDU

1 - A Framework for Evaluating Passenger Delays in Traffic Flow Management
Douglas Fearing, MIT, Operations Research Center, Cambridge, MA, 02139, United States of America, dfearing@mit.edu, Cynthia Barnhart, Constantine Caramanis

Many research problems in TFM would benefit from the analysis of passenger delays. This analysis has been difficult to perform as publicly-available data does not contain passenger counts for individual itineraries. Researchers have instead focused on flight-based analyses, which ignore the delays associated with itinerary disruptions. Thus, we propose a framework for simulating disaggregated passenger flows and approximating airline recovery operations to evaluate the passenger impacts of TFM.

2 - Passenger Impacts of Excessive Surface Delays
Frederick Foreman, Ph.D., Senior Analyst, Metron Aviation, 45300 Catalina Ct, Suite 101, Dulles, VA, 20166, United States of America, foreman@metronaviation.com, Dan Larsen

An Excessive Surface Delay (XSD) is defined as an event where passengers spend three (3) hours or more on an aircraft located somewhere on the surface of one or more airports without deplaning. This paper investigates the possible causes of XSDs and their impact on passengers experiencing XSDs ranging from three (3) to nine (9) hours. Case studies of known XSD events are analyzed and their causes are determined. In addition, strategies for modeling and possibly mitigating XSDs are explored.

3 - Explore the Past to Improve the Future: How Airlines Can Benefit From Historial Data?
Niklaus Eggenberg, EPFL, EPFL ENAC Transp-OR, Station 18, Lausanne, CH-1015, Switzerland, niklaus.eggenberg@epfl.ch, Cynthia Barnhart, Virot Chiraphadhanakul

Airlines' schedules are built such as to maximize expected profit. Such schedules turn out to be more sensitive to delay propagation and have lower on-time performance. Robust schedules are thus used instead. In this paper, we compare two different approaches to derive robust schedules, being either based on historical data or not. We show how the way historical data is considered affects the solutions' quality.

4 - A Model of Delay Propagation in a Network of Airports
Nikolas Pyrgiotis, MIT, Cambridge, MA, United States of America, pyrgios@mit.edu

This work is motivated by airport congestion problems and by the necessity to understand the complex interactions that lead to propagation of delays across airport networks. In this talk we present a model that captures the propagation of delays in a network of airports. Each airport is modeled as a single server queuing system where local delays are estimated and then propagated around the network through the aircraft itineraries. The effects of propagation of delays are discussed.

■ SC26

C-Room 31B, Upper Level

Joint Session AAS/TSL: Stochastic Models in Aviation

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Senay Solak, Assistant Professor, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@som.umass.edu

1 - Optimizing Arrival Traffic Managment Given Uncertainties
Clayton Tino, Graduate Research Assistant, Air Transportation Laboratory, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, GA, 30332-0150, United States of America, clayton.tino@gatech.edu, John-Paul Clarke

The implementation of CDA in high density markets is constrained by the ability to merge and space arriving aircraft while avoiding costly, last-minute vectoring. Using fuel-burn optimized, small en-route speed changes, one can manage CDA traffic in the cruise regime. However, this method is highly sensitive to errors in deterministic predicted arrival time calculations. We address this sensitivity by introducing arrival time uncertainty as a constraint in the speed change generation problem.

2 - A Multi-stage Stochastic Programming Approach for the Single-sector Traffic Flow Management Problem
Yu-Heng Chang, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, United States of America, yhchang@gatech.edu, Senay Solak, John-Paul Clarke, Ellis Johnson

We study the stochastic single-sector traffic flow management problem which determines the number of aircraft to send towards a sector and the recourse actions under the uncertainty of weather. Based on our two-stage stochastic model, we extend it to a three-stage one which involves more decision-making points. Since a more integrated model is proposed, a better solution in terms of costs is expected.

3 - Monte Carlo Validation of a Diffusion Model for a Single Airport Queue
David Lovell, Associate Professor, University of Maryland, Department of Civil Engrg., 1173 Martin Hall, College Park, MD, 20742, United States of America, lovell@umd.edu, Kleoniki Vlachou

A diffusion approach to modeling a single airport queue is presented. The diffusion approach requires specifying only two moments of the arrival and service distributions. Monte Carlo techniques are used to validate this assumption across a range of distributions.

■ SC27

C-Room 31C, Upper Level

Efficient Simulation

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Hernan Awad, University of Miami, Department of Management Science, Coral Gables, FL, 33124-6544, United States of America, h.awad@miami.edu

1 - Rare-event Simulation of Smooth Gaussian Random Field
Jingchen Liu, Assistant Professor, Columbia University, 1255 Amsterdam Ave, Room 1030, New York, NY, 10027, United States of America, jcliu@stat.columbia.edu, Jose Blanchet, Robert Adler

We present an algorithm to efficiently compute the tail probabilities for the maxima of Gaussian random fields. In particular, we focus on twice differentiable and stationary fields living in a compact subset of R^d. The efficiency analysis of the algorithm takes advantage of the structures of the random fields around local maxima and area of the excursion set. These properties depend heavily on differentiability and the expansion of the covariance function around origin.

2 - Adaptive Control Variate Methods Using Trust Region Algorithms
Sujin Kim, Assistant Professor, National University of Singapore, Department of Industrial and Systems Eng, Singapore, 117576, Singapore, iseks@nus.edu.sg

We consider adaptive methods based on control variate schemes, where the optimal controls are determined by trust region algorithms. We assume the existence of a parameterized family of control variates and show how such controls can be generated in the Markov-process setting. We discuss the optimization problem of searching for a good choice of parameterization, and study the asymptotic properties and efficiency of the resulting estimator.

3 - Efficient Simulation in Finite Horizon Problems

Leonardo Rojas-Nandayapa, ITAM, Rio Hondo, Mexico City, DF, 01000, Mexico, leorojas@imf.au.dk, Soren Asmussen

Consider f(u,t) the probability that the workload in an empty M/G/1 queue exceeds u at time t, or, equivalently, the ruin probability in the classical Cr-mer-Lundberg model. Assuming service times/claim sizes to be regularly varying, Monte Carlo estimators are suggested, variance estimates are derived, efficiencies are compared numerically and also the estimators are shown to have bounded relative error in some main cases. Extensions to general Lévy processes are treated.

4 - Response Surface Computation via Simulation in the Presence of Convexity

Eunji Lim, Assistant Professor, University of Miami, Room 281, McArthur Engineering Building, University of Miami, P.O. Box 248294, Coral Gables, Fl, 33124-0620, United States of America, lim@miami.edu, Peter Glynn

We will consider the problem of computing a response surface which is known to be convex in the underlying parameter. Our focus is on the case where the underlying parameter resides in a multidimensional space. We will review a method that incorporates the convexity into the function estimator and discuss the asymptotics of this estimator. The effectiveness of this methodology will be illustrated with numerical examples.

■ SC28

H-Room 500, Fifth Floor

Dynamic Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@email.unc.edu

1 - Pricing and Production Policies for an Online Manufacturer

Victor Araman, NYU/AUB, 44 West 4th Street Room 8-74, New York, NY, 10012, varaman@stern.nyu.edu, Bacel Maddah

We consider a manufacturer selling directly to a customer through an online store. A visiting buyer has two options either to customize his product by selecting the different features or to buy "off-the shelf" some pre-built version of the product. We study how this variety available online affects decisions such as pricing and production (i.e. the ratio between make-to-order and make-to-stock) policies.

2 - Mitigating Strategic Consumer Behavior via Innovative Pricing Strategies

Yossi Aviv, Professor of Operations Management, Washington University in St. Louis, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States of America, AVIV@WUSTL.EDU

In this talk, we will discuss ways in which sellers can adopt creative dynamic pricing schemes to optimally price products in the face of strategic consumer behavior. Such innovative pricing schemes should be tailored to discourage strategic waiting for price discounts, but should not harm the sellers' ability to segment customers.

3 - Stochastic Quasi-Gradient Methods for Dynamic Pricing

Song (Alex) Yang, The University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, 60637, United States of America, syang1@chicagobooth.edu, John Birge

In the traditional dynamic pricing literature, demand function estimation and pricing are done separately. In this talk, we take an alternative approach by considering demand learning and pricing jointly. We apply stochastic gradient method to dynamic pricing with unknown demand function. The advantage of this non-parametric method is that we don't need to assume any specific functional form of the demand distribution.

4 - Choosing the Customer Signal in Personalized Dynamic Pricing of Limited Inventories

Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@unc.edu

We consider a firm selling a product with a limited inventory over a finite horizon. Each arriving customer provides a signal that gives some indication about the customer's reservation price. The firm's objective is to maximize its expected profit by setting prices depending on the customer signal, the inventory level, and time. Under some reasonable assumptions, we establish conditions under which one particular signal leads to higher optimal expected profits than the other.

■ SC29

H-Room 501, Fifth Floor

Resource Optimization and Renewable Integration

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Shmuel Oren, Professor, University of California, Berkeley, 4119 Etcheverry Hall, Berkeley, CA, 94720, United States of America, oren@ieor.berkeley.edu

1 - Ensuring Revenue Adequacy of Financial Transmission Rights with Transmission Switching

Kory Hedman, PhD Candidate, University of California, Berkeley, 4124 Etcheverry Hall, University of California, Berkeley, Berkeley, CA, 94720, United States of America, kwh@berkeley.edu, Richard O'Neill, Shmuel Oren

The current push to create the smart grid includes research suggesting that we should co-optimize generation along with the network topology. However, optimizing the topology may cause revenue inadequacy of FTRs. We present a transmission switching formulation that includes a feasibility test in order to guarantee that the chosen topology solution is revenue adequate; this guarantee only holds under a DC load flow setting. We also discuss alternative ways of addressing this problem.

2 - Swapping Generators' Assets: Market Salvation or Wishful Thinking

Golbon Zakeri, University of Auckland, 70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz, Anthony Downward, David Young

In April this year the New Zealand Commerce Commission released a review of the New Zealand Electricity Market (NZEM) which was followed by a ministerial review of the NZEM. Both of these reviews a number of asset swap and divestiture options for improving the NZEM. We will present the examine these suggestions in presence of changing costs and line constraints. We will demonstrate that for our simple examples, these structural changes will achieve the opposite of what was intended.

3 - Infrastructure Improvements and Total Welfare in an Electricity Market with Fuel Network

Sarah Ryan, Professor and Director of Graduate Education, Iowa State University, Dept of Industrial & Manufacturing Syste, 3004 Black Engineering Building, Ames, IA, 50011-2164, United States of America, smryan@iastate.edu, Andy B. Philpott, Golbon Zakeri, Anthony Downward

We formulate a game consisting of a minimum cost fuel dispatcher, generators in Cournot competition, and an independent system operator (ISO) that sets nodal prices to balance electricity supply with linear demand functions. A Nash equilibrium exists. Under different assumptions about generator rationality with respect to ISO decisions, paradoxical effects on total welfare can result from expanding capacity of either electricity transmission or low-cost fuel transportation.

4 - Net Emissions Impacts of Plug-In Hybrid Electric Vehicles

Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu, Paul Denholm

We use a unit commitment model to estimate the net emissions impacts of plug-in hybrid electric vehicles (PHEVs) under a controlled charging scenario in which the system operator has some flexibility in controlling PHEV charging. Our results show that controlled charging can result in significant generation efficiency gains and actually reduce generator emissions of NOx, despite net increases in generation. We also estimate SO2 and CO2 emissions and the impact of vehicle to grid services.

■ SC30

H-Room 502, Fifth Floor

Forestry I: Timber Harvest Scheduling

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Forest Management under Market Uncertainty
Andres Weintraub, Professor, University of Chile, Beauchef 850, Santiago, Santiago, Chile, aweintra@dii.uchile.cl, Antonio Alonso, Laureano Escudero, Monique Guignard, Martin Quinteros

We consider the problem of planning timber harvest and building access roads when demand is uncertain. This is formulated as a multistage stochastic integer programming problem, with scenarios representing prices and ranges of possible sales. We developed a Branch and Fix coordinated algorithm to solve it. When compared with a deterministic approach using averages, the stochastic approach is clearly superior, obtaining robust results, and producing feasible solutions for all scenarios.

2 - Imposing Old-growth Patch Constraints in Forest Harvest Scheduling Models
Marcos Goycoolea, Universidad Adolfo Ibañez, Diagonal Las Torres 2640, Peñalolén, Santiago, Chile, mgoycool@gmail.com, Juan Pablo Vielma, Andres Weintraub, Miguel Constantino

One way of addressing wildlife preservation concerns in harvest scheduling is to require large contiguous patches of mature forest to be left standing after harvest. We discuss modeling and solution techniques for integrating this constraint in existing revenue-maximizing models and present computational results on real medium-sized forest instances found in the FMOS repository.

3 - Optimal Cable Corridor Layout for a Given Road Network
Leo Bont, ITES-Land Use Engineering Group, CHN K 75.1, ETH-Zentrum, Zurich, Switzerland, leo.bont@env.ethz.ch, Hans Rudolf Heinimann

Cable corridor layout is a challenging decision for timber harvesting on steep slopes. We introduce an approach to identify an optimal layout, formulated as a MIP cascading facility location problem, which can be solved with a commercial solver. Model application to terrain units of about 10 hectares gives results in reasonable time.

■ SC31

H-Room 503, Fifth Floor

Industrial Applications of Revenue Management and Pricing Methods

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Erol Biberoglu, Hotwire.com, 655 Montgomery St. #600, San Francisco, CA, 94111, United States of America, ebiberoglu@hotwire.com

1 - Assortment and Shelf Space Optimization in Retail
Kerem Tomak, Information Resources Inc, 150 North Clinton Rd., Chicago, United States of America, ktomak@gmail.com

In this talk, we will present state of the art techniques which combine panel, pos and loyalty data to help retailers in their assortment planning and shelf space allocation tasks. We will discuss their application in a large retail store.

2 - Optimal Segmentation via Opaque Pricing
Chris Anderson, Assitant Professor, The school of Hotel Administration, Cornell Univeristy, 335A Statler Hall, ithaca, NY, 14850, United States of America, canderson@cornell.edu, Kristine Xie

Opaque pricing allows the sale of differentiated products at higher prices to brand loyal customers while selling to non loyal customers at lower prices.We develop a model of consumer choice that illustrates segmentation via opaque pricing.We model a monopolist selling via 3 channels:full information channel,opaque posted price channel,opaque bidding channel.We show segmentation created by opaque pricing and compare optimal revenues and prices for sellers with and without opaque pricing.

3 - Market-Level Pricing for Hotels and Gaming Resorts
Ahmet Kuyumcu, President, Prorize, 12138 Madison Drive, Atlanta, GA, United States of America, akuyumcu@prorize.com, Amar Duggasani, Utku Yildirim

Many hotel chains and gaming resorts own more than one property in the same market, often directly competing with each other. In this situation, each property typically has a property-focused pricing approach, which leads to suboptimal results. This presentation explores key challenges and discusses real-world examples.

■ SC32

H-Room 504, Fifth Level

Portfolio Credit Risk

Cluster: Financial Engineering
Invited Session

Chair: Kay Giesecke, Assistant Professor, Stanford University, Management Science and Engineering, Stanford, CA, United States of America, giesecke@stanford.edu

1 - Bilateral Counterparty Risk Valuation with Stochastic Dynamical Models and Application to CDS
Agostino Capponi, PhD, California Institute of Technology, Paadena, CA, 91125, acapponi@caltech.edu, Damiano Brigo

We introduce the general arbitrage-free valuation framework for counterparty risk adjustments in presence of bilateral default risk, including default of the investor. We illustrate the symmetry in the valuation and show that the adjustment involves a long position in a put option plus a short position in a call option, both with zero strike and written on the residual net value of the contract at the relevant default times. We allow for correlation of investor and counteparty default times.

2 - Default Clustering and Valuation of Collateralized Debt Obligations
Steven Kou, Professor, Columbia University, 312 Mudd, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States of America, sk75@columbia.edu, Xianhua Peng

The recent financial turmoil has witnessed the powerful impact of the default clustering effect. We propose a model based on {\it cumulative} default intensities that can incorporate the default clustering effect. The model is tractable enough to provide a direct link between single-name credit ecurities, such as credit default swaps (CDS), and multi-name credit securities, such as CDOs. The result of calibration to the recent market data during the crisis shows that the model is promising.

3 - Multi-Scale Time Changes Birth Processes for Pricing Multi-Name Credit Derivatives
Erhan Bayraktar, Assistant Professor, University of Michigan, Department of Mathematics, 530 Church Street, Ann Arbor, MI, 48109, United States of America, erhan@umich.edu, Bo Yang

We develop two parsimonious models for pricing multi-name credit derivatives. We derive closed form expression for the loss distribution, which then can be used in determining the prices of tranche and index swaps and more exotic derivatives on these contracts.

4 - What is Default and When is the Recovery?
Xin Guo, Associate professor, UC at Berkeley, Berkeley, United States of America, xinguo@newton.berkeley.edu

Our recent empirical studies of distressed debt prices suggest that proper understandings default and recovery are critical for credit risk management. We show that identifying the "economic default" date, as distinct from the traditional default date, is crucial to obtaining unbiased estimates for recovery rate. This is a joint work with R. Jarrow of Cornell, and H.Z. Lin of CSFB.

■ SC33

H-Room 505, Fifth Floor

Models with Positive Externalities between Customers in Operations Settings

Cluster: Economic Models in Operations Management
Invited Session

Chair: Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

1 - Firm Service Rate Selection When Quality and Service Rates are Unknown
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We study how a high quality service firm may set its service rates to differentiate from a low quality service firm, when the firm can neither communicate its service value nor its service rate to customers. Rational agents make joining decisions without observing the service rate or quality. We find that the combination of uncertainty about the quality of the service and the service rate can lead to a higher profits for service firms.

2 - Designing and Marketing Techno-Fashion Products: The Effect of Consumer Social Interaction

Jiong Sun, Illinois Institute of Technology, Chicago, IL, jsun22@iit.edu, Jinhong Xie

Consumers who want to signal their uniqueness gain social utility if their products contrast with others, whereas those who wish to conform gain social utility by acquiring what others already have. We analyze how such socially-driven preferences affect firms' new product design and marketing decisions. Specifically, we examine when to introduce an advanced version of a product and how to differentiate the advanced version from the existing version in terms of functionality and fashion.

3 - Herding Behavior with Heterogeneously Informed Customers

Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

In this talk, I discuss how the presence of customers that are heterogeneously informed about the quality of a service influence a firm's service rate selection.

■ SC34

H-Room 520, Fifth Floor

Economics of Environmental Operations

Cluster: Green Supply Chain
Invited Session

Chair: Atalay Atasu, Georgia Institute of Technology, Atlanta, GA, United States of America, Atalay.Atasu@mgt.gatech.edu

1 - Component Commonality under Product Remanufacturing

Ravi Subramanian, Professor, Georgia Tech, Ravi.Subramanian@mgt.gatech.edu, Mark Ferguson, Beril Toktay

We assess the profitability of an OEM implementing component commonality when remanufactured versions of products are sold along with new products.

2 - Turning Waste into By-Product

Deishin Lee, Professor, HBS, Soldier's Field Rd, Morgan 415, Boston, MA, 02163, United States of America, dlee@hbs.edu

We determine, in a competitive setting, the optimal operating regimes of a firm that converts its waste into a useful by-product. The original product and by-product subsidize each other: the original product "feeds" the by-product process and the by-product "consumes" the original product's waste. These two subsidies act as mechanisms to transfer wealth between the original and by-product markets. We analyze the environmental impact of turning waste into by-product.

3 - The Impact of Take-Back Legislation on Remanufacturing

Gokce Esenduran, Ph.D. Student, UNC, gokce_esenduran@unc.edu, Eda Kemahlioglu-Ziya, Jay Swaminathan

There is disagreement on whether takeback legislation will induce or hinder remanufacturing. We use a stylized model with three levels of legislation (no legislation, legislation on collection levels, legislation on collection and reuse levels) and aim to understand whether legislation causes an increase in remanufacturing levels and if it induces an OEM (who remanufactures in-house or whose products are remanufactured by a third-party) to manufacture products that are cheaper to remanufacture.

4 - Environmental Taxes and the Choice of Pollution-Reducing Technology

Anton Ovchinnikov, Professor, Darden School, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, OvchinnikovA@darden.virginia.edu, Dmitry Krass

We study how environmental taxes or pollution fines motivate adoption of innovative and "green" pollution-reducing technologies. We consider how the firm is choosing its technology (among alternatives that vary in emissions reduction, fixed and variable costs) and market behavior (pricing and production quantity) in response to a tax level, and then consider how anticipating firm's response the regulator is setting tax level strategically to achieve its tax revenue and environmental objectives.

■ SC35

H-Sapphire A, Fourth Floor

Healthcare Management - Planning

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - An Integrative Approach to Capacity Planning in the Health Care Sector

Guoxuan Ma, K. U. Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Guoxuan.Ma@econ.kuleuven.be, Erik Demeulemeester, Lu Wang, Jeroen BeliÎn

The capacity planning problem consists of determining how resources are allocated to specialties and how many patients from each pathology can be treated, which results in the length of the waiting list and affects the patient flow. This paper simultaneously considers hospital profits and patient satisfaction through incorporating an optimization model to produce an optimal case mix and resource allocation scheme and a simulation approach reflecting the impact of variability on performance.

2 - Which Level of Detail is Best for Supporting Medical Managers with Strategic Patient Mix Decisions?

Paul Joustra, PhD student, Academic Medical Center, Meibergdreef 9, Amsterdam, Netherlands, P.E.Joustra@amc.nl, Jesse de Wit, Nico van Dijk, Piet Bakker

Due to budget restrictions, medical managers have to decide which patient groups to treat. We developed a user-friendly, interactive decision support tool to show the consequences of these decisions in terms of the waiting times for an outpatient department and operating theatre of an ophthalmology department in a teaching hospital. We experimented with different levels of detail to decide upon the level best suited to supporting strategic patient mix decisions.

3 - Retail Pharmacy Workflow Process and Patient Wait Time: A Simulation Approach

Shital Shah, Assistant Professor, Rush University Medical Center, 1700 W. Van Buren St, 126B, Chicago, IL, 60612, United States of America, Shital_C_Shah@rush.edu, Denise Farnum, Matthew Kemper, Daniel Sheedy, Jeremy Strong, Labinot Avdiu

As retail pharmacies are competing in oversaturated markets, superior customer services with minimal wait time are becoming integral part of the competitive business operations. In this study, simulation modeling was utilized to identify bottlenecks and test "what-if" scenarios in a large outpatient academic medical center pharmacy with a goal of minimizing wait time. In the most operational iteration, the walk-in patients wait time reduced by 32% to 36%.

4 - Impact of the Value of Information in ICU Admissions and Capacity Planning

Imran Hasan, Gradute Research Assistant, Purdue University, United States of America, ihasan@purdue.edu

Emergency Department(ED) Crowding has become a major problem in ED's all across the US over the past decade or so. One of the reasons commonly cited as a cause for this problem is the unavailability/ lack of beds in the intensive care unit (ICU). There is a wide body of literature on the development of models for the prediction of length of stay (LOS), in both inpatient units and ICUs. However, there has been no research pertaining to the advantages of such predictive models. Our goal is to evaluate the impact of knowing the LOS in advance, and how it can help in the planning of admissions and capacity decisions in the ICU.

■ SC36

H-Sapphire B, Fourth Floor

Impacting Health Policy through Operations Research

Sponsor: Health Applications
Sponsored Session

Chair: Elvira Loredo, Researcher, Full, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90404, United States of America, loredo@rand.org

1 - Software to Optimize the Location of Points-of-Dispensing (PODs)

Paul Sorensen, Operations Researcher, RAND, 1776 Main Street, Santa Monica, CA, 90404, United States of America, sorensen@rand.org

In the event of a major public health emergency, local public health departments will receive appropriate countermeasures from the Strategic National Stockpile and then set up a network of PODs (points of dispensing) to distribute the medications to the population. In this presentation we will discuss and demonstrate a spatial optimization tool designed to assist local health departments in the task of selecting an efficient and operationally feasible set of POD locations.

■ SC37

H-Sapphire C, Fourth Floor

Supply Chain Management and Fast Fashion

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

Co-Chair: Felipe Caro, University of California, Los Angeles, CA, fcaro@ucla.edu

1 - Quick Response and Retailer Effort

Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Harish.Krishnan@sauder.ubc.ca

If a manufacturer initiates quick response (QR) and reduces inventory levels at a downstream retailer, this will induce the retailer to exert less effort when demand realization is low. QR can therefore lead to lower sales of the manufacturer's product and higher sales of competing products. Take-or-pay provisions, advance purchase discounts and exclusive dealing can ensure that QR does not hurt the manufacturer. We present evidence from recent anti-trust cases in support of our results.

2 - Strategic Assortment Rotation

Felipe Caro, Assistant Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, fcaro@anderson.ucla.edu, Victor Martinez de Albeniz

Fast fashion retailers are known for their quick response to market changes. This allows them to change the assortment more frequently, which induces repeated visits to the store, which in turn increases sales. We propose a customer consumption model with satiation and multiple competing retailers. The model implies that consumers will spend more at retailers that revise their assortment more often. We then determine the competitive equilibrium and the optimal assortment duration.

3 - Connecting Lead Time and Sales in Fast Fashion

Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Alejandro Lago, Philip Moscoso

The paper studies empirically if differences in supply lead-times exert an influence on product sell-thru in fast fashion companies. POS sell-thru data for over a thousand SKUs in one particular company are analyzed. We show taht shorter supply lead-times generally improve product sales, but assortment decisions may mitigate the effect.

4 - Distribution-Free Inventory Management in Fast Fashion

Michael Wagner, CSUEB, 25800 Carlos Bee Blvd, Hayward, United States of America, michael.r.wagner@gmail.com

In this talk we present an inventory management framework that models fast fashion products as perishable items. Since new fashion items do not have historical data with which to create demand forecasts, we assume the demand for these items is unknown without a characterizing probability distribution. We study this problem from a worst case perspective and provide robust procurement quantities for fast fashion products.

■ SC38

H-Sapphire D, Fourth Floor

Assemble-to-order Production/Inventory Systems

Cluster: Inventory Management
Invited Session

Chair: Mustafa Kemal Dogru, Researcher, Alcatel-Lucent Bell Labs, Blanchardstown Industrial Park, Blanchardstown, Dublin, 15, Ireland, dogru@alcatel-lucent.com

1 - Priority and Reservation Based Inventory Policies for Assemble-to-Order Systems

Marty Reiman, Alcatel-Lucent Bell Labs, 600 Mountain Ave., Murray Hill, NJ, United States of America, marty@research.bell-labs.com, Qiong Wang, Mustafa Kemal Dogru

We use a single-period stochastic programming model to guide the development of a priority and reservation based inventory policy for multi-period Assemble-to-Order (ATO) systems including both continuous and periodic review cases. The effectiveness of this approach is demonstrated by numerical tests on some well-known ATO structures such as the W and M systems.

2 - The Value of Component Commonality under Non-Holdback Allocation Rules

Junmin Shi, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States of America, jshi@pegasus.rutgers.edu, Yao Zhao

We study the impact of component commonality in a continuous-time assemble-to-order system with positive lead times, base-stock policy and non-holdback allocation rules. We prove that the total backorder and total on-hand inventory decrease with probability one as the degree of commonality increases. We also derive approximations on the long-run average cost and study the impact of commonality on it.

3 - Control of a High-Volume Assemble-to-Order with Maximum Leadtime Quotation

Amy Ward, USC, Marshall School of Business, BRI401H, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu, Erica Plambeck

For an assemble-to-order system with a high volume of prospective customers arriving per time unit, we show how to set nominal component production, quote prices and maximum leadtimes for products, and then, dynamically, sequence orders for assembly and expedite components. We further discuss a complication that arises when customers are heterogeneous in their delay tolerance, and the system manager attempts to implement price discrimination through leadtime differentiation.

■ SC39

H-Sapphire E, Fourth Floor

Management of Product Variety

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Muge Yayla-Kullu, Asst. Professor, Lally School of Mgmt. & Tech., RPI, Troy, NY, 12180, United States of America, yaylah@rpi.edu

1 - Product Variety, Pricing and Differentiation in a Supply Chain

Sampath Rajagopalan, srajagop@marshall.usc.edu, Nan Xia

The costs and benefits of product variety vary across different players in a supply chain and this has interesting ramifications. Motivated by observations in the DVD industry, we present a model wherein a manufacturer sells product variants at a wholesale price to two competing but differentiated retailers. We provide results on the impact of retailer differentiation, manufacturer and retailer costs, etc. on variety, prices and margins. We also explore some coordination issues in the channel.

2 - Vertical Differentiation and Capacity Planning when the Market's Potential and Size are Uncertain

Sergio Chayet, Olin Business School, Washington University in St Louis, One Brookings Drive, St. Louis, 63130, United States of America, chayet@wustl.edu, Panos Kouvelis, Dennis Yu

We study the quality level and capacity planning decisions of a firm facing a market of heterogeneous customers in their design quality valuations. Both the size and overall potential of such market are uncertain. The firm makes capacity and design quality level decisions for vertically differentiated products ex ante, and makes pricing decisions once demand has been realized. We discuss key tradeoffs and insights generated by our model.

3 - Commonality in Product Line Design under Negatively Correlated Preference Structure

Dilip Chhajed, Professor, University of Illinois, 1206 S. Sixth Street, Champaign, IL, 61820, United States of America, chhajed@illinois.edu, Kilsun Kim

We present a model of product line design with two attributes for which consumer segments exhibit opposite preference ordering and study the implications of making an attribute common. Our results show that commonality strategy, when it saves cost, i) can intensify or relieve cannibalization problem, ii) can make a first best solution implementable even when it is not under non-commonality strategy, and iii) can reduce product differentiation along the attribute that is not common.

4 - Asymmetric Competition in Vertically Differentiated Markets

Muge Yayla-Kullu, Asst. Professor, Lally School of Mgmt. & Tech., RPI, Troy, NY, 12180, United States of America, yaylah@rpi.edu, Jay Swaminathan

We study an asymmetric Stackelberg competition in a vertically differentiated market. The products are differentiated by their quality, unit cost and resource consumption levels. Customers are heterogeneous in their willingness to pay for quality. In this context, we investigate how a traditional incumbent would respond to a focused strategy entrant that has to make capacity investments. We discuss the implications on product variety and capacity choices.

■ SC40

H-Sapphire H, Fourth Floor

Advances in Financial Engineering Methods

Sponsor: Financial Services
Sponsored Session

Chair: Jim Primbs, Asst. Professor, Stanford, 444 Terman Engr. Ctr., Stanford, CA, 94305-4026, United States of America, japrimbs@stanford.edu

1 - Optimal Hedging of Illiquid Asset Derivatives Using Additive Models

Yuji Yamada, Associate Professor, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo, 112-0012, Japan, yuji@gssm.otsuka.tsukuba.ac.jp

We consider a minimum variance hedging problem for a derivative security with untraded underlyings using liquidly traded assets. We provide a two step algorithm in which we compute the additive sum of smooth functions of traded assets that minimizes the mean square error from the payoff of the derivative security. We show that the problem is reduced to a system of linear operator equations that can be solved efficiently.

2 - Option Pricing in Incomplete Markets: Computation and Convergence

Farid AitSahlia, University of Florida, 303 Weil Hall, Department of Industrial & systems engg, Gainesville, FL, 32611, United States of America, farid@ise.ufl.edu

I present a new approach to deal with option pricing in incomplete markets. Its discrete form relies on matroid theory to determine minimal-entropy martingale pricing measures through corresponding independent bases. Convergence to associated continuous models is obtained through nonstandard analysis, which helps to seamlessly move between discrete and continuous models.

3 - A Linear Control Framework for Dynamic Hedging

Jim Primbs, Asst. Professor, Stanford, 444 Terman Engr. Ctr., Stanford, CA, 94305-4026, United States of America, japrimbs@stanford.edu

Using a combination of basis functions and Monte Carlo sampling, we reformulate the multi-dimensional dynamic hedging problem as a linear quadratic control problem. This allows us to use standard linear control methods such as Riccati equations and receding horizon control to solve the hedging problem, even in the presence of transaction costs and other constraints. Numerical examples demonstrate the efficiency and accuracy of the linear control approach.

4 - Fragility of CVaR in Portfolio Optimization

Gah-Yi Vahn, PhD Student, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, gyvahn@berkeley.edu, J. George Shanthikumar, Andrew Lim

We evaluate conditional value-at-risk (CVaR) as a risk measure in data-driven portfolio optimization. We show that portfolios obtained by solving empirical mean-CVaR problems are fragile due to estimation errors of CVaR and/or the mean, which are aggravated by optimization. This problem is exacerbated as the tail of the return distribution is made heavier. We conclude that data-driven mean-CVaR problem is fallible, and propose alternative approaches to using CVaR in portfolio optimization.

■ SC41

H-Sapphire L, Fourth Floor

Sustainability and Co-value Creation

Sponsor: Korea Chapter-INFORMS (KINFORMS)
Sponsored Session

Chair: Sang Hyung Ahn, Professor, Seoul National University, School of Business, Seoul, Korea, Republic of, shahn@snu.ac.kr

1 - Value Code Assessment in Korea Prieum Business Firms

Chang Won Lee, Operations and Service Management, School of Business, Hanyang University, Seoul, 133-791, Korea, Republic of, leecw@hanyang.ac.kr, Sang Hyung Ahn

Value code assessment in Korean firms is a strategic investment decision making. Data envelopment analysis (DEA) is utilized for business efficiency in Korean firms. The DEA model uses four input and four output variables to assess the business efficiency of the firms. The model identifies the best and non-best firms. The study provides the management with more valuable insights in order to make better investment decisions in the global business environment.

2 - A Case Study of Servitizatioin for Korean Manufacturing Companies

Youn Sung Kim, Professor, Inha University, Korea, 253 Yonghyun-dong, Nam-ku, Incheon, 402-751, Korea, Republic of, keziah@inha.ac.kr, Seungwook Park

We analyzed multiple Korean manufacturing companies to understand how they transformed their business models for servitization which enabled them to change from making a product to serving it. Woongin, like GE and Rolls Royce transforming their business model successfully, invented a new business model for product servitization. In this paper, the reasons and purposes of Woongin's servitization are investigated throughout its reinvented business model.

3 - Operational Efficiency, Perceived Service Quality and Business Performances of Bank Branches

Hong-il Kim, Ph.D. Candidate, Korea University, Anam-Dong, Seongbuk-Gu, Korea University Business School A516, Seoul, 136-701, Korea, Republic of, itlime@korea.ac.kr, Hosun Rhim, Shijin Yoo

We examine the relationship among operational efficiency, perceived service quality and business performance of bank branches. Data indicating operational performances of branches have been collected. Perceived service qualities of customers and employees have been surveyed with SERVPERF questionnaire. We use DEA to evaluate operational efficiency of the branches and SEM to investigate the relationship.

4 - Models for Scheduling Business Jet Aircraft

Hongsuk Yang, Seoul National University, 599 Gwanangno Gwanak-gu, Seoul, 151-916, Korea, Republic of, hongsuk@snu.ac.kr, Jiyoung Park

The purpose of this research is to design the optimal models for Korean Business Jet companies. They are planning to run a business jet covering North Asian countries such as Korea, China and Japan. We suggest a simple model considering the operating cost, repair and maintenance cost, airport fee, crew payrolls, etc. By using distance between cities and estimated passenger data, we develop cost minimizing fleet/flight schedules for business jet operators.

5 - The Ownership Structure of Foreign Subsidiaries: The Effect of Institutional Distance

Naoki Ando, Associate Professor, Hosei University, 2-17-1 Fujimi Chiyoda-ku, Tokyo, 1028160, Japan, nando@hosei.ac.jp, Nobuya Fukugawa

This study examines how institutional distance between a host and a home country influences the ownership structure of foreign subsidiaries. The study shows that internationally experienced firms tend to have a larger portion of equity ownership in institutionally distant countries. This study also reveals that when a parent firm has substantial international and host country experience, the greater institutional distance leads to the greater ownership level.

■ SC42

H-Sapphire P, Fourth Floor

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu

1 - Summary of the 2009 Nicholson Prize

Michael Ferris, Professor, University of Wisconsin-Madison, Madison, WI, United States of America, ferrism@cs.wisc.edu

A brief overview of the review process used, along with a list of finalists will be given.

2 - Small Approximate Pareto Sets for Bi-objective Shortest Paths and Other Problems

Ilias Diakonikolas, Columbia University, 469 Computer Science Building, New York, NY, 10027, ilias@cs.columbia.edu, Mihalis Yannakakis

We investigate the problem of computing a minimum set of solutions that approximates within a specified accuracy ϵ the Pareto curve of a multi-objective optimization problem. We show that for a broad class of bi-objective problems (containing many important widely studied problems such as shortest paths, spanning tree, matching and many others), we can compute in polynomial time an ϵ-Pareto set that contains at most twice as many solutions as the minimum such set. Furthermore we show that the factor of 2 is tight for these problems, i.e., it is NP-hard to do better. We present upper and lower bounds for three or more objectives, as well as for the dual problem of computing a specified number k of solutions which provide a good approximation to the Pareto curve.

3 - Manipulation Robustness of Collaborative Filtering Systems
Xiang Yan, Stanford University, Packard 274, Stanford, CA, United States of America, robbie.yan@cs.stanford.edu, Benjamin Van Roy

A collaborative filtering system recommends to users products that similar users like. Collaborative filtering systems influence purchase decisions, and hence have become targets of manipulation by unscrupulous vendors. We provide theoretical and empirical results demonstrating that while common nearest neighbor algorithms, which are widely used in commercial systems, can be highly susceptible to manipulation, two classes of collaborative filtering algorithms which we refer to as linear and asymptotical ly linear are relatively robust. These results provide guidance for the design of future collaborative filtering systems.

4 - A Price-dependent Demand Substitution Rule and its Applications
Ye Lu, MIT, Cambridge, MA, 02139, United States of America, yelu@mit.edu, David Simchi-Levi

In a multi-product market, if one product stocks out, consumers may substitute to competing products. In this research, we apply an axiomatic approach to characterize a price-dependent demand substitution rule, and provide a sufficient and necessary condition for demand models where our demand substitution rule applies. Our results can serve as a link between the pricing and inventory literature, and enable the study of joint pricing and inventory coordination as well as retail competition.

■ SC43

H-Room 400, Fourth Floor

Pricing and Supply Uncertainties in Supply Chain Design

Cluster: Supply Chain Models
Invited Session

Chair: Yimin Wang, Assistant Professor, Arizona State University, Department of Supply Chain Mgmt, P.O. Box 874706, Tempe, AZ, 85287, United States of America, yimin_wang@asu.edu

1 - The Impact of Yield-Dependent Costs on Pricing and Production Planning under Supply Uncertainty
Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, bkazaz@syr.edu, Scott Webster

This paper considers the impact of yield-dependent purchasing cost and salvage revenue on the choice of the selling price and production quantity for an agricultural firm operating under supply uncertainty. It shows the conditions under which the use of a static cost exaggerates the value gained from a secondary purchase option, concluding that supply uncertainty presents a higher risk for agricultural firms than businesses who operate under static cost parameters.

2 - Joint Bidding and Procurement Strategies under Fluctuating Purchase Prices
Xiaofeng Nie, Postdoctoral Research Fellow, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, xiaofeng.nie@mail.mcgill.ca, Saibal Ray, Dan Zhang, Tamer Boyaci, Mehmet Gumus

We consider a single firm selling a product periodically by submitting bids. Facing stochastic procurement prices, the firm needs to decide on both the bidding price and the procurement quantity with the objective of maximizing total expected discounted profit. A dynamic programming formulation is proposed and some numerical results are presented.

3 - Market Share Competition on Initial Investment and Production
Jin Kyung Kwak, Cornell University, 201 Sage Hall, Ithaca, NY, 14853, United States of America, jkk37@cornell.edu, Nan Yang

This study investigates competition on initial investment and production to gain market shares. By analyzing a single-period game where each firm competes on its initial investment and production to maximize its expected profit, we show the existence of a unique equilibrium and give an efficient algorithm to compute the equilibrium. We also compare the firms' optimal decisions in this decentralized setting with those in a centralized setting.

4 - Supply Disruption and Restoration
Xinxin Hu, Assistant Professor, Indiana University, 1309 East 10th Street, Bloomington, IN, 47405, United States of America, hux@indiana.edu, Ling Wang, Haresh Gurnani

The possible catastrophic disruption will fail the supplier's capacity. Even with the supplier's effort to restore his capacity, the retailer still faces the risk of the insufficient supply, since such restoration effort is usually more costly and unpredictable. Basing on the single wholesale price contract, we study how the retailer places orders and proposes the incentive ordering price to push desired effort level invested by the supplier to sufficiently restore his capacity.

■ SC44

H-Room 402, Fourth Floor

Workforce Management: Problems and Models

Sponsor: Service Science
Sponsored Session

Chair: Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com

1 - Interesting Packing/Covering Formulations of a Flexible Staffing Problem Arising in Service Delivery
Pranav Gupta, IBM - India Research Lab, Vasant Kunj Inst Area, Delhi, India, prguptan@in.ibm.com, Gyana Parija, Sambuddha Roy

This paper addresses the business problem of recommending optimal mix of core & part-time employees, their daily schedules to meet incoming varying demand. We propose a MIP for this problem, which is a generalized version of covering a rectilinear polygon with axis parallel rectangles (Chaiken et al. gave a P time algorithm for special cases); here we can use only two types of rectangles (with associated weights) with the objective of minimizing the weighted combination of the rectangles chosen.

2 - Optimatch: Assignment and Capacity Planning of Highly Skilled Employees Using Constraint Programming
Sigal Asaf, IBM, Haifa University Campus, Haifa, Israel, SIGALAS@il.ibm.com, Will Riddle, Michael J. McInnis, Crystal L. Conner, Yael Ben-Haim, Yossi Richter, Yehuda Naveh, Donna L. Gresh, Daniel P. Connors, Julio Ortega

Matching highly skilled people to positions is a high-stakes task that requires careful consideration by experienced managers. A wrong decision may result in significant losses. We present Optimatch, a Constraint Programming (CP) solution that generates near-optimal assignment and supports the capacity planning process. CP is well-suited for dealing the field's complex constraints and can support thousands of positions and resources. Optimatch is deployed throughout IBM's services organizations.

3 - Analytics for Semi-automated Screening of Candidates for Recruiting in Growth Markets
Nanda Kambhatla, Senior Researcher, IBM India Research Lab, Block D, Embassy Golf Links, Koramangala, Bangalore, 560071, India, kambhatla@in.ibm.com, Vijil Chentamarakshan, Swati Challa

In growth markets, companies often receive thousands of resumes for job openings. Screeners review the candidates to shortlist a few. We present a system that ranks candidates for each job opening, allowing screeners to reject candidates en-mass and shortlist a few of them. The ranking is done by text analysis of resumes and free text portions of job descriptions. This results in increased productivity of recruiters, a more uniform screening process, and identification of better candidates.

4 - Stochastic Modeling Approach for Prescribing Optimal Workforce Levels for BPO Industry
Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com, Gyana Parija, Vinayaka Pandit

We present a stochastic programming model for optimal workforce hiring and deployment decisions for non-voice processes for Business Process Outsourcing companies. The model uses MILP approach to optimize on a multitude of business objectives. It uses scenario trees to model stochastic demand. We further present usage scenarios that can help the companies provide differentiated services by entering into revenue sharing agreement with the clients.

■ SC45

H-Room 410, Fouth Floor

Incentive Issues in Product Design and Development

Cluster: New Product Development
Invited Session

Chair: Sreekumar Bhaskaran, Asst. Professor, SMU-Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@mail.cox.smu.edu

1 - Impact of the Cost of Components and Demand Risk in the Selection of a Product Platform
Saurabh Bansal, UT Austin, Austin, Austin, TX, United States of America, Saurabh.Bansal@phd.mccombs.utexas.edu, Genaro Gutierrez

We explore conditions under which a common platform is preferred over separate platforms when these platforms are to be coupled with vertically differentiated components manufactured by a co-production system. We model the two tradeoffs between the higher cost of the common platform and its two benefits: (i) downward substitution of the co-produced component, and 2)

operational hedge. We identify the co-production yields, and the demand uncertainties under which the common platform is preferred.

2 - Strategic Information Disclosure in Competitive R&D Projects
Yi Xu, Assistant Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, yxu@rhsmith.umd.edu, Manu Goyal

Firms often form beliefs on how lucrative an R&D project is based on competing firms' R&D spending and success. We analyze such a scenario where a Leader firm's R&D effort is interpreted by a Follower firm to customize its own research foray. Thus the Leader firm strategically distorts its R&D effort in an attempt to mislead the Follower firm the distortion depends crucially on whether the uncertainty is on the technological dimension of the R&D project, or on the market potential.

3 - Platform Feature Investment in the Presence of Network Externalities
Burcu Tan, PhD Candidate, University of Texas at Austin, IROM, B6500, 1 University Station, Austin, TX, 78712, United States of America, Burcu.Tan@phd.mccombs.utexas.edu, Geoffrey G. Parker, Edward G. Anderson Jr.

We examine the development of product platforms in markets that exhibit network externalities. We focus on the trade-offs firms must make between investing new product development resources to increase a platforms core functionality versus investments designed to change or leverage the platforms network externalities. Abstracting from examples drawn from multiple industries, we use a strategic model to gain intuition about how to make such trade-off decisions.

4 - How Should Universities Participate in the Profits of University Spinouts?
Nicos Savva, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nsavva@london.edu, Niyazi Oztoprak

We examine how should a University participate in the profits of a venture capital (VC) backed spin-out company that commercialises the outcome of academic research. We assume that the VC is better informed about the cost of development than the University. We examine the trade-offs of royalty and equity participation under asymmetric information and identify mechanisms that incentivise the VC to reveal the true cost estimates.

■ SC46

H-Room 411, Fourth Floor

Technology Management under Risk

Sponsor: Technology Management
Sponsored Session

Chair: Leonardo Santiago, Federal University of Minas Gerais, Production Engineering Deparment, Av. Antonio Carlos, 6627 - Pampulha, Belo Horizonte, MG, Brazil, lsantiago@ufmg.br

1 - The Impact of Risk Management in Project Performance
Marly Monteiro Carvalho, Associate Professor, University of S„o Paulo, Av Professor Almeida Prado, trav 2, 128, S„o Paulo, 05508-900, Brazil, marlymc@usp.br, Roque Rabechini Jr

The main focus of this study is the impact of risk management in project performance. We identified in ISI Web of Science database 70 articles that contained 'risk management', 'project' and 'performance' or 'success'. We identified 15 key issues in risk management. The hypotheses were tested based on a field study with 257 projects. The results show that high degree of risk management implementation may result in project's success, since significant differences were identified.

2 - Learning in Online Communities. The Case of Rooster Teeth
Stefan Haefliger, Researcher, ETH Zurich, Kreuzplatz 5, Zurich, 8032, Switzerland, shaefliger@ethz.ch, Peter Jaeger, Georg von Krogh

Communities of users or consumers generate insights about products that may help other users or inspire manufacturers to learn about trends in the market and innovate. Little is known about the value creation in communities of consumption. We analyze a large online customer community of a Machinima production company that produces animated shorts in computer games. A significant amount of users provided comments with specialized feedback that eventually lead to innovation.

3 - A Qualitative Approach for Economic Evaluation of Technological Project Risks
Jose Luis Ribeiro, Dr., UFRGS, Av. Osvaldo Aranha 99, 5o Andar, Porto Alegre, Brazil, ribeiro@producao.ufrgs.br, Rogerio Miorando

This paper presents a qualitative approach for risk assessment of technological projects. The approach uses matrices to identify potential risks and probabilities. The main contribution of the proposed approach is the procedure used to quantify potential profits associated to technological projects under evaluation. The approach converts the different aspects of technological projects to financial units, allowing a complete an innovative analysis of the alternatives involved.

4 - On the Time Uncertainty of New Product Development Projects
Thiago Augusto Oliveira Silva, Graduate Student, Federal University of Minas Gerais, Belo Horizonte, Brazil, thiagoaos@ufmg.br, Leonardo Santiago

In this paper we compare two different approaches to the problem of capturing the impact of time uncertainty in the payoff of technology projects. The first considers the project payoff vis-ver-vis the notion of a window of opportunity, while the second one tackles project payoff as a function of a commodity's price. Implications of these two approaches are discussed.

■ SC47

H-Room 412, Fourth Floor

Doing Good with Good OR Student Competition II

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu

Co-Chair: Cynthia Barnhart, Associate Dean for Academic Affairs, MIT, School of Engineering, Cambridge, MA, 02139, United States of America, cbarnhart@MIT.EDU

1 - Doing Good with Good OR Student Competition
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu, Cynthia Barnhart

"Doing Good with Good OR Student Competition" is a new INFORMS sponsored competition to encouraging student research and practice with societal impact. This competition is intended to recognize student-led projects with real-world clients that generate significant societal impacts beyond increased profits or reduced costs. The finalists session will feature the most exciting work performed by students in partnership with public and private organizations that results in tangible, beneficial outcomes for individuals, communities and organizations. The winner of the competition will be decided after the presentations and announced at the awards ceremony on Sunday night.

2 - Using Models of Hepatitis B to Influence Public Health Policy
David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

We have used Markov models to analyze the cost-effectiveness of several interventions to combat hepatitis B. In sharing the results of these models, we have helped change US policy to encourage screening of millions of people and we hope to influence policymakers in China to enact guidelines to provide catch-up vaccination for hundreds of millions of children.

3 - At What Lipid-ratios Should a Patient with Type 2 Diabetes Initiate Statins?
Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Nilay Shah, Steven Smith, Andrew Schaefer, Brian Denton

Lipid abnormalities elevate the risks of coronary heart disease (CHD) and stroke for patients with Type 2 diabetes and can be treated by statins with adverse side effects. We formulate the optimal timing of statin initiation problem as an infinite-horizon Markov decision process and explore several structural properties of the resulting treatment policies. We analyze the sensitivity of these policies with respect to varying risk factors and present computational results based on clinical data.

■ SC48

H-Sapphire Green Room, Fourth

Complex Decision Making in Service Operations

Sponsor: Service Science
Sponsored Session

Chair: Christian Wernz, Assistant Professor, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, wernz@vt.edu

1 - Making Complex Decisions with Experiments
Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

The fundamental challenges in decision making in complex systems services are: One:the multidisciplinary nature of the decision problem. Two, the uncertainty

associated with the decision and its potential outcomes. In this presentation we present an analytic approach to address this problem. The approach is presented with an example to make it easy to understand.

2 - Computational Thinking of Service Systems: An Operational Perspective

Robin Qiu, Penn State, 30 E. Swedesford Road, Malvern, United States of America, gxq102@gv.psu.edu

Using computational thinking, we propose an approach, which shall provide with the means to explore, model, capture, and manage systemic behaviors, interactions, connections, complex relations, and interdependencies of service systems, resulting in the better understanding of what constitutes an effective and robust service systems and under what conditions and agile transformation service systems' performance and potential would be more predictable, controllable, competitive, and sustainable.

3 - The Interaction of Positive Externalities and Congestion Effects in Online Services

Ramesh Johari, Stanford University, ramesh.johari@stanford.edu, Sunil Kumar

Motivated by online services such as virtual communities and massively multiplayer online games, we study a system where a service is shared by many identical customers. Each customer experiences congestion due to all users' utilization of a common resource. In addition, we assume each customer experiences a positive externality from other users. We characterize the "club" formed by self-interested users, as well as the optimal decision of a service manager who controls access but not usage.

4 - Multiscale Decision-Making for a Maintenance Service Problem

Christian Wernz, Assistant Professor, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, wernz@vt.edu, Andrew Henry

Decisions in service operations are complex since they involve various interdependent agents at different hierarchical levels. A three-level maintenance service problem is analyzed using the multiscale decision-making model. The multiscale decision-making model fuses game theory, stochastic modeling and dependency graphs into a unified framework. In this service application, we identify incentive mechanisms that align the interests of account managers with maintenance supervisors and workers.

■ SC49

H-Room 300, Third Floor

Software Project Management

Cluster: Project Management
Invited Session

Chair: Yong Tan, Associate Professor of Information Systems, University of Washington, Foster School of Business, ytan@u.washington.edu

1 - The Effects of Free Trials and Product Ratings on Software Trial under Information Diffusion

Young Jin Lee, University of Washington, Foster School of Business, Box 353200, Seattle, WA, 98195, United States of America, younglee@u.washington.edu, Yong Tan

Distributing free trials of software in public is a common practice of most commercial publishers in software market. We develop an empirical framework to analyze the impact of two types of free trials and the ratings on consumer software sampling under the Bass type diffusion setting. Our results show that freeware is not always a dominant strategy in software sampling and third-party rating sends much stronger signals to potential users when the rating is at or above 4-star on a 5-star scale.

2 - Learning From Past Failures: An Empirical Study of Security Vulnerabilities

Guoying Zhang, Assistant Professor, Midwestern State University, 3410 Taft Blvd., DB273, Wichita Falls, TX, 76308, United States of America, grace.zhang@mwsu.edu, Yong Tan

We investigate software vendors' learning activities from security vulnerabilities. We are interested in whether learning from past failures helps software vendors achieve better security quality of software products and, if so, which characteristics of vulnerabilities are important for effective learning. Three models are applied to discover the learning process. We find that vendors' learning process is dynamic, and is best represented by a hidden Markov model.

3 - The Impacts of Shared Experiences in Software Development: Are They homogeneous?

Keumseok Kang, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, kangk@purdue.edu, Jungpil Hahn

Shared experience (i.e., experience working together) among software project team members is known to affect a project team's performance. However, are the impacts of shared experiences homogeneous? We investigate this question. We empirically find that the impacts of shared experience among project team members on a project's performance may vary by the outcomes of shared experience (e.g., successful vs. unsuccessful) as well as project roles (e.g., project managers) in the current project.

4 - The Impact of Knowledge Transfer on Quality and Productivity in Software Development

Min-Seok Pang, Ph.D. Candidate, University of Michigan, Stephen M. Ross School of Business, 701 Tappan St., R0400, Ann Arbor, MI, 48109, United States of America, mins.pang@gmail.com

In developing a software product, developers utilize their expertise and apply their knowledge into the product. We expect that active knowledge transfer between software developers and their effective knowledge application into software projects can lead to an improvement in quality and productivity. We intend to find answers to two research questions - how does knowledge transfer influence on quality and productivity and what factors facilitate knowledge transfer of software developers.

■ SC50

H-Room 302, Third Floor

Economics of Information Systems

Sponsor: Information Systems
Sponsored Session

Chair: Amit Mehra, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, Amit_Mehra@isb.edu

1 - Advertising Strategies for Competing Internet Retailers

Ram Bala, Assistant Professor, Indian School of Business, Hyderabad, India, Ram_Bala@isb.edu, Amit Mehra, Jagmohan Raju

We consider duopoly competition between retailers who have the option of using cost per impression (CPM) and/or cost per click (CPC) advertising to reach their customers. We analyze the relative use of CPM and CPC by both firms at equilibrium as a function of the market size and whether the retailer is known or unknown. Under some conditions, the profits of both retailers may increase if the known retailer uses its website as a portal and charges a fee per transaction from the unknown retailer.

2 - Emergence of Opinion Leaders in Online Review Communities

Param Singh, Assistant Professor, CMU, 5000 Forbes Avenue, Pittsburgh, United States of America, psidhu@andrew.cmu.edu, Yingda Lu, Kinshuk Jerath

We study the drivers of the emergence of reviewers as opinion leaders in a large online movie review community (epinions.com). We find that while the "rich gets richer" phenomenon and review characteristics such as objectivity, comprehensiveness, Fog index are significant drivers of the emergence of a reviewer as an opinion leader, their combined effect is substantially weaker than that of a process whereby reviewers choose those reviewers as opinion leaders who have been more active recently.

3 - Buyer-seller Networks and Market Outcomes in Software Development Contracting

Siva Viswanathan, Associate Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Mingfeng Lin

IT has led to the increased the use of markets for software development projects, but uncertainties remain high due to the "credence" nature of software development. Using data from an online marketplace for software projects, we study the creation, maintenance, and decay of different types of vendor-client relationships, and how they impact outcomes.

4 - Optimal Seeding Strategies in the Presence of Network Effects

Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

We discuss how seeding can be used to help drive adoption of technologies with positive network effects. We look at optimal seeding strategies, involving giving away the product for free to a subset of customers and show that while such strategies can be hard to compute, certain heuristic strategies perform well. We also show how the benefits of seeding and the choice of seeded customers report are inextricably tied to the structure of spillovers.

■ SC51

H-Room 303, Third Floor

Optimization and Complementarity: Algorithms and Applications

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Che-Lin Su, The University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, Che-Lin.Su@chicagogsb.edu

1 - Decentralized Risk Management of a Financial Conglomerate
Adam Speight, Assistant Professor, Georgia State University, 197 15th St NW, Atlanta, GA, 30318, United States of America, aspeight@gmail.com

I present a new framework for measuring the aggregate risk profile of a firm based only on inputs provided by individual business units. The value-maximizing firm's problem subject to regulatory constraints is decentralized and shown equivalent to a nonlinear complementarity problem. Dual variables coordinate prices in an intra-firm market for capital and risk limits among diverse business units using heterogeneous models.

2 - A Globally Convergent Filter Method for MPECs
Todd Munson, Scientist, Argonne National Lab, United States of America, tmunson@mcs.anl.gov, Sven Leyffer

We propose a new method for mathematical programs with complementarity constraints that is globally convergent to B-stationary points. The method solves a linear program with complementarity constraints to obtain an estimate of the active set. It then Åxes the activities and solves an equality-constrained quadratic program to obtain fast convergence. The method uses a Ålter to promote global convergence. We establish convergence to B-stationary points.

3 - Verifiable Conditions of L1-recovery of Sparse Signals with Sign Restrictions
Fatma Kilinc Karzan, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, fkilinc@gatech.edu, Anatoli Juditsky, Arkadi Nemirovski

We propose necessary&sufficient conditions for a sensing matrix to be s-semigood - to allow for exact L1-recovery of sparse signals with at most s nonzero entries under sign restrictions. We express error bounds for imperfect L1-recovery in terms of these characteristics. These, despite being difficult to evaluate, lead to verifiable sufficient conditions and efficiently computable upper bounds on those s for which a given matrix is s-semigood.We study their properties and limits of performance.

■ SC52

H-Room 304, Third Floor

Product Design and Assortment

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Sezer Ulku, Assistant Professor, Georgetown University MSB, 37 & O St, Washington, DC, 20057, United States of America, SU8@msb.edu

1 - The Decision-making on Product Specifications and Priority Uncertainty
Zhijian Cui, PhD Candidate, INSEAD, 40 Ave. Alfred Roll, Bois le Roi, 77590, France, Zhijian.CUI@insead.edu, Christoph Loch

Our study looks at the "gaming" among various stakeholders behind product specification decisions. Previous research mainly discusses how firms incorporate new information into design as external uncertainty resolves.However,the issue of how firm's internal uncertainty drives false definition, over-specification has been overlooked. By comparing outputs under different power allocation, our study shows how stakeholders "priority uncertainty" affects product design and design failure.

2 - Assortment Selection in Dual Sales Channels
Betzabe Rodriguez, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, betzabe@umich.edu, Goker Aydin

We consider a build-to-order manufacturer who sells an assortment of products through both a direct channel and an independent retailer (e.g., Dell selling through BestBuy). We study the tension between the retailer's and the manufacturer's preferences regarding the retailer's assortment. We find that the retailer may wish to carry a smaller assortment in an effort to curb the manufacturer's wholesale price.

3 - On the Interaction between Retail Pricing, Assortment, and Inventory Decisions
Shiguang Xie, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, ryanxie@vt.edu, Bacel Maddah

We study pricing, assortment and inventory decisions for horizontally differentiated items. We analyze the effect of inventory costs on pricing and variety. We find that (i) accounting for inventory limits variety even if pricing is endogenous, and (ii) the optimal price is adjusted up or down from the riskless price.

4 - Upgrade Choice: Modular Upgrade vs. Full Product Replacement
Sezer Ulku, Assistant Professor, Georgetown University MSB, 37 & O St, Washington, DC, 20057, United States of America, SU8@msb.edu, Glen Schmidt, Claudiu Dimofte

Modularity allows buyers to adapt products over time in line with changing needs and technological improvements; it can also alleviate environmental problems. We examine how consumers upgrade modular products, and show that such products are often replaced in full. We show that it is possible to encourage modular replacements through the use of certain levers which either reduce the perceived effort, or increase the utility associated with the modular alternative.

■ SC53

H-Room 305, Third Floor

Advances in Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca

1 - Generalized MIR Cuts: Results and Computation
Jean-Philippe Richard, Associate Professor, Department of Industrial and Systems Engineering of University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, richard@ise.ufl.edu, Young Park, Santanu Dey

We study an extension of the simple MIR set that has an arbitrary number of unstructured constraints and that contains two integer and one continuous variable. We describe a polynomial algorithm to generate the facet-defining inequalities of the convex hull of mixed integer solutions to this set, and shows that it yields a polynomial algorithm to generate cuts that consider multiple rows of the problem simultaneously. We report on our computational experience with these new cutting planes.

2 - Strengthening Lattice-free Based Cuts Using Nonnegativity
Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca, Oktay Gunluk

Borozan and Cornuejols (2008) and Andersen et.al (2007) recently studied valid inequalities for mixed-integer sets defined by multiple rows where each row has exactly one integer variable which is not restricted in sign. Cutting planes based on this approach have already been used for general mixed-integer problems and show promise to be useful. In this work, we require the integer variables to be non-negative and show how to obtain stronger cuts by exploiting such requirement.

3 - Constrained Infinite Group Relaxations of MIPs
Santanu Dey, CORE, Louvain-La-Neuve, Belgium, Santanu.Dey@uclouvain.be, Laurence Wolsey

One method of generating cutting planes for general MIPs is to use extreme inequalities of its group relaxations. Recently, there has been renewed interest in studying the continuous infinite group relaxation -a set involving m equality constraints with m free integer variables and non-negative continuous variables. In this talk we consider a stronger relaxation of general MIPs by allowing constraints, such as bounds, on the free integer variables in the continuous group relaxation.

■ SC54

H-Room 306A, Third Floor

Optimization in Metric Spaces

Sponsor: Optimization/Networks
Sponsored Session

Chair: Aleksandrs Slivkins, Researcher, Microsoft Research (SVC), 1065 La Avenida, Mountain View, CA, 95134, United States of America, slivkins@microsoft.com

1 - A Computational Theory of Clustering

Maria Florina Balcan, Assistant Professor, Georgia Institute of Technology, School of Computer Science, Atlanta, GA, 30332, ninamf@cc.gatech.edu, Avrim Blum, Santosh Vempala

In this work we propose a new general framework for analyzing clustering from similarity information that directly addresses the question of what properties of a similarity measure are sufficient to cluster accurately and by what kinds of algorithms. We show that in our framework a wide variety of interesting learning-theoretic and game-theoretic properties can be used to cluster well, and we design new efficient algorithms that are able to take advantage of them.

2 - Nearly Tight Low Stretch Spanning Trees

Ittai Abraham, Researcher, Microsoft Research (SVC), 1065 La Avenida, Mountain View, CA, 95134, United States of America, ittaia@microsoft.com, Yair Bartal, Ofer Neiman

We prove that any graph G on n vertices has a distribution over its spanning trees such that for any edge (u,v) the expected stretch E_T[d_T(u,v)] is bounded by \tilde{O}(\log n). Our result is obtained via a new approach of building "highways" between portals and a new strong diameter probabilistic decomposition theorem.

3 - Approximating Geometric Steiner Forest

Glencora Borradaile, Oregon State University, Corvallis, OR, United States of America, glencora@eecs.oregonstate.edu, Claire Mathieu, Philip Klein

Given a set of pairs of points, what is the minimum-length network that connects each pair of points? This is the geometric Steiner forest problem. In graphs and high-dimension Euclidean space, the problem admits no polynomial-time approximation scheme and the best known approximation is 2. For fixed epsilon, we give an O(n polylog n)-time algorithm that finds a (1+epsilon)-approximation for instances in the Euclidean plane. Joint work with Philip Klein and Claire Mathieu.

4 - Multi-armed Bandits in Metric Spaces

Aleksandrs Slivkins, Researcher, Microsoft Research (SVC), 1065 La Avenida, Mountain View, CA, 95134, United States of America, slivkins@microsoft.com, Robert Kleinberg, Eli Upfal

In a multi-armed bandit problem, an online algorithm chooses from a set of strategies in a sequence of trials so as to maximize the total payoff of the chosen strategies. We study a very general setting for the multi-armed bandit problem, motivated by practical applications such as online auctions and web advertisement, in which the strategies form a metric space, and the payoff function satisfies a Lipschitz condition with respect to the metric.

■ SC55

H-Room 306B, Third Floor

Dynamic Auctions

Sponsor: Optimization/Networks
Sponsored Session

Chair: Liad Blumrosen, Department of Economics, The Hebrew University, Jerusalem, 91905, Israel, blumrosen@gmail.com

1 - Efficient Metadeliberation Auctions

Ruggiero Cavallo, University of Pennsylvania, 114 S. 19th St., #1A, Philadelphia, PA, 19103, United States of America, cavallo@seas.upenn.edu, David Parkes

We consider a resource allocation scenario in which the interested parties can, at a cost, individually (and privately) research ways of using the resource, potentially increasing the value they would achieve from obtaining it. There is a value-improvement/cost tradeoff. We reduce computing the optimal research/allocation policy to computing Gittins indices for multi-armed bandits, and apply a modification of the dynamic-VCG mechanism to yield truthful participation in an ex post equilibrium.

2 - Self-Correcting Sampling-Based Dynamic Multi-Unit Auctions

Florin Constantin, Harvard University, 33 Oxford St, Cambridge, United States of America, florin@eecs.harvard.edu

We present the first use of online stochastic optimization for incentive-compatible dynamic auctions with partially patient, multi-unit demand bidders. We achieve strategyproofness via a self-correcting procedure applied to a heuristic version of the Consensus algorithm. We show empirically that the price of strategyproofness is limited with respect to both performance and computation requirements.

3 - Peer Influence and Information Diffusion in Online Social Networks: An Empirical Analysis

Rajiv Garg, Carnegie Mellon University, 4800 Forbes Ave, Suite 242, Pittsburgh, PA, 15213, United States of America, rg@cmu.edu, Mike Smith, Rahul Telang, David Krackhardt

Over the last few years, online networks have been gaining popularity and allowing community members to share and exchange information. But due to information overload the traditional modes of diffusion have been losing effectiveness. With the increase in online trust, online social networks are becoming the platform of choice for product advertising and discovery. We found that the online peers indeed influence other peers and enable discovery of niche music on social networks.

■ SC56

H-Room 307, Third Floor

Global Optimization in the Presence of Errors

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Omid Nohadani, MIT, 77 Massachusetts Ave, E40, Cambridge, MA, 02139, United States of America, nohadani@mit.edu

1 - The Nested Event Tree Model with Application to Combating Terrorism

Brian J. Lunday, Ph.D. Candidate, Grado Department of Industrial and Systems Engineering, Virginia Polytechnic Institute and State, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, lunday@vt.edu, Theodore S. Glickman, Hanif D. Sherali

We present a nested event tree optimization framework for minimizing the expected loss inflicted by a terrorist organization by allocation of capability-, intent-, vulnerability-, and consequence-related resources. For the resulting specially structured nonconvex factorable program, we develop three algorithms (each with a special-case variant) that attain a global optimal solution and demonstrate all six strategies to outperform the commercial software BARON in extensive testing.

2 - Deterministic Global Optimization of Semi-Infinite Programs

Alexander Mitsos, Assistant Professor, Massachusetts Institute of Technology, Department of Mechanical Engineering, 77 Massachusetts Avenue, MIT 3-158, Cambridge, MA, 02139, United States of America, mitsos@MIT.EDU

A deterministic algorithm is proposed for the global solution of SIPs without any convexity/concavity assumptions. The algorithm employs an upper bound based on a restriction of the right-hand-side of the constraint and a discretization of the parameter set and a lower bound based on discretization of the parameter set. Finite termination is proved and the advantages of the proposed algorithm over existing algorithms are demonstrated by numerical examples.

3 - Scatter Search in Process Engineering Optimization

Jose A. Egea, Dr., IIM-CSIC, Eduardo Cabello, 6, Vigo, 36208, Spain, jegea@iim.csic.es, Julio R. Banga

Scatter search has proved to be efficient and robust to solve optimization problems from process engineering. Here we present a scatter search-based method for solving continuous global optimization problems in that area. We will illustrate the capabilities of the method by applying it to a set of process engineering optimization problems and comparing its results with those obtained by other state-of-the-art global optimization methods.

4 - Robust Optimization with Simulated Annealing

Omid Nohadani, MIT, 77 Massachusetts Ave, E40, Cambridge, MA, 02139, United States of America, nohadani@mit.edu, Dimitris Bertsimas

An optimized solution can become suboptimal or even infeasible, when errors are encountered. We present a robust simulated annealing algorithm that does not require any knowledge of problem structure. This is necessary in many engineering applications where solutions are not explicitly known and obtained via simulations. Our method is computationally efficient and warrants for a global optimum which is robust against uncertainties. We demonstrate it on a high-dimensional nanophotonic problem.

■ SC57

H-Room 308, Third Floor

Disease Modeling

Sponsor: Health Applications
Sponsored Session

Chair: Pinar Keskinocak, Associate Professor, Georgia Tech, School of Industrial and Systems Enginee, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, pinar@isye.gatech.edu

1 - A Non-homogenenous Agent-based Simulation Predict Disease Spread in a Pandemic Outbreak

Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca, Brian Schwartz, Theodorus Wibisono

The need for accurate disease spread data was highlighted during the Severe Acute Respiratory Syndrome (SARS) outbreak in 2002-2003. Previous studies of disease spread make overly simplistic assumptions and assume that all people are identical. We propose an agent-based simulation model that treats each member of the population as unique. The results of the model are output to geographic information system (GIS) software for visualization. A pilot study of the model is tested on Toronto, Canada.

2 - Modeling of the Spread of Methicillin-resistant Staphylococcus Aureus (MRSA)

Bruce Lee, Assistant Professor of Medicine, Epidemiology, and Biomedical Informatics, University of Pittsburgh, 200 Meyran Ave., Suite 200, Pittsburgh, PA, 15213, United States of America, BYL1@pitt.edu

Methicillin-resistant Staphylococcus aureus (MRSA), an antibiotic-resistant bacteria, is a major problem in many countries, resulting in significant morbidity, mortality, and rising health care costs and capturing the attention of public health officials, lawmakers, and health care administrators. This session will present computer models that simulate the spread of MRSA throughout a county and the potential effects of various prevention and control strategies and interventions.

3 - Modeling Seasonality and Strain Mutation in a Pandemic Influenza

Pengyi Shi, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30318, United States of America, shipengyi@gmail.com, Pinar Keskinocak, Bruce Lee, Julie Swann

Multiple waves of attack in a pandemic influenza has been observed in the past. We investigated the reasons of such multi-attacks by modeling two potential factors: seasonal change and strain mutation. Based on a spatial-temporal disease spread model incorporated with the two factors, our simulation showed that multiple attacks may happen under the joint effect of seasonality and mutation. We reproduced a mortality pattern with 3 peaks similar to the one observed in 1918.

4 - Balancing HIV Treatment with Harm Reduction for Injection Drug Users in Ukraine

Sabina Alistar, Student, Stanford University, MS&E Department, Terman Building, Stanford, CA, 94305, United States of America, ssabina@stanford.edu, Margaret Brandeau

Ukraine has the fastest growing IDU-driven HIV epidemic in Europe. With limited resources, the tradeoff between expanding access to treatment and scale-up of harm reduction programs (methadone substitution) is a relevant question for decision makers. We describe a dynamic compartmental model to investigate the cost-effectiveness of multiple strategies to manage the epidemic.

■ SC58

H-Room 309, Third Floor

Scheduling Operations in Manufacturing/Service Systems

Cluster: Scheduling
Invited Session

Chair: Chelliah Sriskandarajah, Professor, The University of Texas at Dallas, 800 West Campbell Rd. SM30, School of Management, Richardson, TX, 75080, United States of America, chelliah@utdallas.edu

1 - Throughput Optimization in Robotic Cells under Circular Layout is NP-Hard

Tharanga Rajapakshe, UTD, 800 W. Campbell Road, Richardson, Tx, 75080, United States of America, tkr051000@utdallas.edu, Milind Dawande, Chelliah Sriskandarajah

We consider the problem of optimizing throughput in single-gripper, bufferless robotic cells that produce identical parts under the free-pickup criterion and the additive-travel-time metric. The problem of finding an optimal 1-unit cycle is shown to be NP-hard for cells under circular layout. We also provide a polynomial-time 5/3-approximation algorithm .

2 - Pool-Point Distribution of Zero-Inventory Products

Neil Geismar, Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, NGeismar@mays.tamu.edu, Milind Dawande, Chelliah Sriskandarajah

A production facility with an adjustable production rate uses pool-point (or hub-and-spoke) distribution for its limited-lifetime product, which cannot be inventoried. Each pool point may require multiple truckloads. The delivery of the product is done by identical trucks, each having limited capacity and non-negligible traveling time between the plant and the pool points. Our objective is to coordinate the production and transportation operations so that the total cost is minimized.

3 - Emerging Inventory Models in the Cash Supply Chain

Yunxia Zhu, University of Texas at Dallas, 800 West Campbell Rd, SM 30, Richardson, tx, 75080, United States of America, yxz067000@utdallas.edu

We devise and analyze novel inventory models resulting from the new currency recirculation policy introduced in 2007 by the U.S. Federal Reserve. Our analysis provides managers of depository institutions (banks) with optimal or efficient currency management strategies under all possible cost structures and demand patterns.

4 - Optimal Scheduling of Mobile Advertisements

Subodha Kumar, Assistant Professor, Texas A&M University, Mays Business School, 301-F Wehner Building, 4217 TAMU, College Station, TX, 77843, United States of America, subodha@tamu.edu, Tridib Bandyopadhyay, Milind Dawande, Vijay Mookerjee

Mobile wireless devices are increasingly becoming powerful platform for advertising because they can be used to track physical location of its users. However, the ineffective advertisements not only increase the cost to the advertisers, but may also create a negative value for the item. Hence, the firms need to make the advertising decisions judiciously. We optimize the decisions for a large marketing firm which needs to maximize the effectiveness of advertisements in a given planning horizon.

■ SC59

H-Room 310, Third Floor

Tutorial: Supply Chain Management in the Context of Humanitarian Disasters

Cluster: Tutorials
Invited Session

Chair: Luk Van Wassenhove, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, luk.van-wassenhove@insead.edu

1 - Supply Chain Management in the Context of Humanitarian Disasters

Luk Van Wassenhove, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, luk.van-wassenhove@insead.edu

Disaster logistics differ from business logistics because of dynamic environments and the need for impartiality, neutrality and humanity. Funding is declining, and disasters become more frequent, humanitarians increasingly rely on private organizations for help, although collaboration is difficult. We introduce disaster supply chain management, outline the need for better preparedness and response, discuss opportunities for effective collaboration, and highlight opportunities for research

■ SC60

H-Room 311, Third Floor

Some Advances in Conic Optimization

Cluster: Large Scale Optimization (In Honor of Jean-Louis Goffin)
Invited Session

Chair: Mohammad Oskoorouchi, College of Business Administration, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, 92096, United States of America, moskooro@csusm.edu

1 - An Interior Point Constraint Generation Method for Semi-infinite Linear Programming

Mohammad Oskoorouchi, College of Business Administration, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, 92096, United States of America, moskooro@csusm.edu, Hamid Ghaffari, Tamas Terlaky

We present an interior point constraint generation algorithm for semi-infinite linear optimization and prove that the algorithm converges to an ε-solution after a finite number of constraints is generated. We implement our algorithm to solve second-order cone optimization (SOCO) problems and compare our numerical results with that of SeDuMi and show that our method outperforms classical primal-dual interior point methods on a class of large-scale SOCO problems.

2 - Full-Newton Step Polynomial-time Methods for LO Based on Locally Self-concordant Barrier Functions

Kees Roos, TU Delft, Mekelweg 4, Delft, Netherlands, C.Roos@tudelft.nl, H. Mansouri, G. Lesaja

Recently, several interior-point methods were introduced by using barrier functions that are based on kernel functions. These barrier functions are not self-concordant. Near the central path, however, they behave as being self-concordant. Using this we prove that for full-Newton step variants of these methods the iteration bound is the currently best known bound for LO.

3 - Relationships Among Some Geometric Measures of Convex Cones

Levent Tuncel, Professor, University of Waterloo, Department Combinatorics and Optim., 200 Unversity Avenue, West, Waterloo, ON, N2L3G1, Canada, ltuncel@math.uwaterloo.ca, Hugo Lara

We study geometric measures of convex cones and present various relationships among the width, the norm approximation coefficient, Caratheodory number and Goffin-Cheung-Cucker measure of convex cones.

■ SC61

H-Room 312, Third Floor

Competitive Location

Sponsor: Location Analysis
Sponsored Session

Chair: Tammy Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, tdrezner@fullerton.edu

1 - A Competitive Location Model: Improving Attractiveness of Chain Facilities

Pawel Kalczynski, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, pkalczynski@fullerton.edu, Zvi Drezner, Tammy Drezner

In this paper we apply cover models to competitive facility location models. The cover radius of a facility depends on its attractiveness. The cost of constructing a facility is a function of its radius. We investigate both constructing new competing facilities and upgrading one's chain facilities or a combination of both by allocating a given budget among existing and/or new chain facilities.

2 - Locating Capacity and Reactive Banks in Electrical Power Networks

Vladimir Marianov, Professor, Universidad Catolica de Chile, Santiago, Chile, marianov@ing.puc.cl, Felipe Tapia, Luis Vargas

We propose a procedure to locate capacity and reactive banks in an electrical network so to supply the demand over a time horizon and keep quality and reliablity standards, under different failure and demand scennarios, at a minimum cost. The procedure is tested on a network serving six million people.

3 - Hotelling Models with Asymmetry

H. A. Eiselt, University of New Brunswick, New Brunswick, Canada, haeiselt@unb.ca, Vladimir Marianov

This presentation considers a variety of standard Hotelling models with firms that have different objectives. We first study the sensitivity of the models as far as Nash locational equilibria are concerned, and we then examine von Stackelberg solutions and determine when a first mover advantage exists.

4 - Big Segment Small Segment Global Optimization Algorithm on Networks

Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu, Oded Berman, Dmitry Krass

The branch and bound procedures: Big Square Small Square and the Big Triangle Small Triangle were proposed to solve single facility location problems in the plane. We propose a similar branch and bound approach to solve single facility location on the network when the facility can be located anywhere on the network.

■ SC62

H-Room 313, Third Floor

Human Behavior in Supply Chains

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Karen Donohue, Associate Professor, Carlson School, University of Minnesota, 321 19th Ave S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, donoh008@umn.edu

1 - Simple Reactive Strategies in Repeated Interactions between Supplier and Retailer

Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg

It has been observed that supply chain transactions between suppliers and retailers often take simple forms, for example, linear wholesale price transaction. This research studies how simple reactive strategies evolve and affect performances in repeated supply chain coordination games.

2 - Is the Newsvendor "Pull-to-Center" Finding an Experimental Artifact

Neil Bearden, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, neil.bearden@insead.edu, Nils Rudi, David Drake

One common objection to experimental studies of the newsvendor problem is that the assumption of a (perfectly) known demand distribution is too strong. We report results from an experiment in which subjects face a newsvendor problem with an unknown demand distribution (neither its form nor its moments are known). We find that whether the demand distribution is known or not has little effect on order quantities. We conclude with a linguistic analysis of the term "bias."

3 - Decision Making Behavior for Pooled Inventory: Learning to Share

Karen Donohue, Associate Professor, Carlson School, University of Minnesota, 321 19th Ave S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, donoh008@umn.edu, Tony Cui, Arthur Hill, Brent Moritz

It is well known that pooling inventory can allow one to reduce inventory investments while maintaining or even increasing service levels. Despite these theoretical benefits, we find that supply chain managers in practice often resist moving to a centralize system and giving up local inventory control. We examine this disconnection between theory and practice by uncovering potential behavioral issues that influence one's ability to effectively share inventory.

■ SC63

H-Room 314, Third Floor

Convex Hull Approximations for Integer and Global Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Suvrajeet Sen, Professor, The Ohio State University, 1971 Neil Ave, Columbus, OH, 43210, United States of America, sen.22@osu.edu

1 - On Polytopes Associated with Products of Discrete Variables

Warren Adams, Professor, Clemson University, Martin Hall, Clemson, SC, 29634, United States of America, wadams@clemson.edu, Stephen M Henry

Linearizations of quadratic binary terms have been well-studied. However, little is known for the discrete case. We characterize desirable extreme point traits of discrete polytopes, and establish fundamental results relative to dimension and facial structure. Convex hull representations are obtained for special instances, and partial such results in general.

2 - Exploiting Multilinearity in Global Optimization Relaxations

Mohit Tawarmalani, Associate Professor, Krannert Graduate School of Management of Purdue University, 4026, RAWLS Hall, 100, S. Grant, West lafayette, IN, 47907, United States of America, mtawarma@purdue.edu, Nick Sahinidis, Xiaowei Bao

We use the convex extensions theory to derive a column-generation algorithm for generating facets of the envelopes of a multilinear function. We provide preliminary computational experience on a variety of global optimization problems. We compare the strength of various commonly used relaxations for the multilinear expressions, discuss generalizations to multilinear sets.

3 - Finite Disjunctive Programming Characterizations for General Mixed-Integer Linear Programs

Binyuan Chen, PhD Students, University of Arizona, SIE Department, Tucson, AZ, 85721, United States of America, bychen@email.arizona.edu, Simge Kucukyavuz, Suvrajeet Sen

We give a finite disjunctive programming procedure to obtain the convex hull of bounded general mixed-integer linear programs. We propose a sequential disjunctive cutting plane algorithm that converges to an integral optimal solution in finitely many iterations. We illustrate the proposed algorithm on three well-known examples in the literature.

■ SC64

H-Room 202A, Second Floor

2009 INFORM-ED Case Competition I

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

1 - 2009 INFORM-ED Case Competition

Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

This session will host the presentations of the finalists for this annual competition. A panel of judges from INFORM-ED will select the winners.

■ SC75

C-Room 32A, Upper Level

Next Generation Car Scheduling Systems I

Sponsor: Railroad Applications
Sponsored Session

Chair: Dharma Acharya, AVP - Operations Research, CSX Transportation, 500 Water St. J315, Jacksonville, FL, 32082, United States of America, Dharma_Acharya@CSX.com

1 - Next Generation Car Scheduling System at Norfolk Southern

Dan Plonk, Director Transportation Planning, Norfolk Southern Coporation, 1200 Peachtree St. NE, Box 158, Atlanta, GA, 30309, United States of America, dan.plonk@nscorp.com

In this presentation, I'll start with an overview of our existing car scheduling system, Algorithmic Blocking & Classification or ABC. I'll describe what ABC is and how it works. Then, I'll focus on the next generation ABC which extends the current ABC algorithms to incorporate shipment delivery time and individual train capacity. The new system will allow us to improve customer service and better utilize capacity. Lastly, I'll outline the next steps.

2 - Current and Future Car Scheduling System at CSX

Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com

In this presentation, we will describe the features and short comings of the existing car scheduling system. We will then describe the desired features/functionalities of the future car scheduling system.

3 - Capacitated Car Scheduling on a Time/Space Network

Chip Kraft, ckraft@temsinc.com

Capacitated Car Scheduling on a Time/Space Network provides an opportunity for railroads to boost capacity by utilizing train capacity that might otherwise go to waste. In an era of rising fuel prices, it may also provide an opportunity to introduce a "Time Definite" service offering into the railroad product mix. We will describe a real-time process control algorithm, based on a revenue management "Bid Price" framework, that has been implemented to make this possible.

Sunday, 4:30pm - 6:00pm

■ SD01

C-Room 21, Upper Level

Decision Analysis Society Practice Award Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

1 - SPRINT: A Decision Analysis Based System for Prioritizing R&D Investments at Baxter Healthcare

Phil Beccue, Director, Baxter Healthcare, One Baxter Way, Westlake Village, CA, 91362, United States of America, phil_beccue@baxter.com, Chris Dalton

Baxter invests nearly $1B annually on innovative science to develop specialty therapies and medical products. SPRINT was developed to bring financial rigor and insights to the tradeoffs required in R&D decision-making. As a unique portfolio system combining spreadsheets and decision analysis software, SPRINT captures technical and commercial uncertainty, and is based on an efficient web-based design to collect, manage, and analyze R&D data.

2 - Decision Support for Patients at the UCSF Breast Care Center

Jeff Belkora, Director, Decision Services, University of California, San Francisco, 3333 California Street, Suite 265, San Francisco, CA, 94118, United States of America, jeff.belkora@ucsfmedctr.org, Shelley Volz, Meredith Loth, Alexandra Teng

Decision Services provides decision support to over 500 patients a year weighing the uncertain risks and benefits of breast cancer treatments at UCSF. The support interventions are based on decision analytic theories and practices and associated with increased patient knowledge. The attending surgeons and oncologists have integrated Decision Services into the clinic workflow. Premedical interns deliver the interventions and carry their decision analytic training into medical school and beyond.

3 - Modular Influence Diagrams and Warranty Cost Reduction

Robert Bordley, Technical Fellow, General Motors, 305500 Mound Road, Warren, United States of America, robert.bordley@gm.com

Certain influence diagram packages (e.g. Analytica) allow the influence diagram to be decomposed into influence diagram modules with the high-level level diagrams assessed by executives and the lower-level influence diagram modules asssessed by subject matter experts familiar. The resulting influence diagram can identify opportunities that cut across functional silos. We illustrate these benefits with a very successful, high-impact application to warranty cost reduction at the author's company

■ SD02

C-Room 22, Upper Level

Non-Expected-Utility Theories

Sponsor: Decision Analysis
Sponsored Session

Chair: Aurelien Baillon, Assistant Professor, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, baillon@ese.eur.nl

1 - Experience, Belief, and Preferences in Decision under Uncertainty

Craig Fox, Professor, UCLA Anderson School, 110 Westwood Plaza #D511, Los Angeles, CA, 90095-1481, United States of America, craig.fox@anderson.ucla.edu

In this paper we critically examine the conditions under which experience-based decision making diverges from description-based decision making. Next we develop an integrative account of decision under uncertainty that incorporates the role of experience, beliefs, risk- and ambiguity-preferences. We use this model to explain several empirical patterns of choice under uncertainty previously identified in the literature and to characterize the impact of increasing experience on decisions.

2 - Testing Critical Properties of Descriptive Models of Decision Making

Michael Birnbaum, Professor, California State University, Fullerton, Department of Psychology, CSUF H-830M, Fullerton, CA, 92834-6846, United States of America, mbirnbaum@fullerton.edu

Critical properties are theorems implied by a model that are violated by at least one other model. The model predicting violations (with parameters) is used to design the test. Systematic violations rule out all models satisfying the property. Failure of violations to materialize means both classes can be retained, but parameters are constrained. Empirical evidence regarding more than a dozen such critical properties is reviewed to compare models of decision making.

3 - Revisiting the Gains-Loss Separability Assumption in Prospect Theory

David Budescu, Professor, Fordham University, Dealy Hall, 441 East Fordham Road, Bronx, NY, 10458, United States of America, budescu@fordham.edu, Han Hui Por

Prospect theory assumes that people encode outcomes as gains/losses. The subjective value of mixed prospects is assumed to be the sum of their corresponding positive and negative components. Previous research (Wu & Markle, 2008 using choices; Budescu & Templin, 2009 using CEs) found different rates of violations of this assumption. We report a new study using both elicitation methods and randomly selected prospects and document the extent (and consistency) of the violations in the two tasks.

4 - Are Subjective Probabilities Sign-dependent?

Aurelien Baillon, Assistant Professor, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, baillon@ese.eur.nl, Han Bleichrodt

We conducted an experiment in which we elicited subjective probabilities through choices. For several events we determined the probability such that a subject is indifferent between getting an outcome with this probability (or nothing otherwise) and getting the same outcome if the event occurs. We used both gains and losses implemented with real incentives. We discuss which model can accommodate our findings.

■ SD03

C-Room 23A, Upper Level

Extensions of Nash Equilibrium Problems

Cluster: Game Theory
Invited Session

Chair: Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu

1 - Advances in Modeling Dynamic Network User Equilibrium

Taeil Kim, PhD Candidate, Pennsylvania State University, 244 Leonhard Building, University Park, PA, United States of America, tzk115@psu.edu, Changhyun Kwon, Tao Yao, Terry Friesz

In this talk, we report on a fixed point algorithm for computing a continuous time dynamic user equilibrium (DUE) for a variety of network loading submodels, including the point queue model and the cell transmission model. A proof of convergence is presented for non-monotonic path delay operators. The results of several numerical experiments for a variety of test problems are also reported.

2 - Risk-averse Nash Equilibrium Problems

Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu, Uma Ravat

We introduce the risk-averse Nash equilibrium problem in which agents have nonsmooth objectives arising from CVaR measures. Under fairly mild assumptions, we prove the existence of equilibria and examine the properties of the smoothed game. Smoothing-based computational schemes for these problems are also studied.

3 - On Functional Evolutionary Variational Inequalities

Lanshan Han, Visiting Assistant Professor, University of Illinois at Urbana Champaign, 117 Transportation Building, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, hanlsh@uiuc.edu, Jong-Shi Pang

We consider a class of dynamic systems whose equilibrium set is the solution set of a static finite-dimensional variational inequality. Various properties of these dynamic systems, such as trajectory convergence property, stability, and mode switching behavior are studied in this paper. We also consider applications in transportation equilibrium analysis.

4 - Refinement of the Generalize-Nash Equilibrium

Ankur Kulkarni, Industrial and Enterprise Systems Engg, UIUC, Urbana, IL, United States of America, akulkar3@uiuc.edu, Uday Shanbhag

Facchinei et al in 2007 showed that a solution to a related variational inequality provides an equilibrium (called a variational eq (VE)) to the generalized Nash game with shared constraints. We investigate when the existence of a generalized Nash Eq (GNE) imply the existence of a VE, i.e. the VE is a refinement of the GNE. We provide conditions for such a refinement to exist in primal and primal dual setting. A comparison is made with the approaches of both Harker and that of Facchinei et al.

■ SD04

C-Room 23B, Upper Level

Optimization Approach for Mechanism Design

Cluster: Auctions
Invited Session

Chair: Peng Sun, Associate Professor, Duke University, One Towerview Rd, Durham, NC, 27708, United States of America, psun@duke.edu

1 - Linear Programming for Mechanism Design: An Application to Bidder Collusion at First-Price Auctions

Peng Sun, Associate Professor, Duke University, One Towerview Rd, Durham, NC, 27708, United States of America, psun@duke.edu, Leslie Marx, Giuseppe Lopomo

We use linear programming techniques to analyze the extent to which collusion in first-price auctions is detrimental to sellers' revenue and efficiency. Contrary to some prior literature, we assume that the cartel cannot prevent its members from bidding at the auction. We show that in certain environments collusion at a first-price auction is not profitable at all. Our results suggest that first-price auctions are more robust to collusion than previously believed.

2 - Multi-Dimensional Mechanism Design: Finite Dimensional Approximations and Efficient Computation

Shouqiang Wang, PhD Candidate, Fuqua School of Business, Duke University, 1 Towerview Dr., Durham, NC, 27705, United States of America, shouqiang.wang@duke.edu, Alexandre Belloni, Giuseppe Lopomo

This paper considers mechanism design problems with multi-dimensional types when the seller's cost function is not separable across buyers. We show that the associated infinite dimensional optimization problem posed by the theoretical model can be approximated arbitrary well by a sequence of finite dimensional linear programming problems. We are able to provide an efficient algorithm of solving this problem by implementing the cutting-plane method.

3 - Characterizing Optimal Adword Auctions

Garud Iyengar, Associate Professor, Columbia University, IEOR Department, New York, NY, 10027, United States of America, garud@ieor.columbia.edu, Anuj Kumar

We present a number of models for the adword auctions used for pricing advertising slots. We discuss two interesting special cases: slot independent valuation and slot independent valuation up to a privately known slot and zero thereafter. Next, we propose a new mechanism that we call the customized rank based allocation and report the results of a numerical study that compare the revenue and efficiency of the proposed mechanisms.

■ SD05

C-Room 23C, Upper Level

Panel Discussion: Curriculum Development in QSR

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu

1 - Curriculum Development in QSR

The current QSR related curricula for graduate students are very diversified in different universities. We should have some efforts to make the QSR curricula more standardized/attractive. This panel will highlight the need for fundamental courses and multi-disciplinary instructions for graduate education in the quality and reliability engineering field. Laboratory facilities and equipment will also be highlighted. An overview of the recent development of quality and reliability education in east Asia region will also be discussed.

2 - Graduate Education in Quality and Reliability Engineering

Panelist: Elsayed Elsayed, Professor, Rutgers University, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu

This talk will highlight the need for fundamental courses and multi-disciplinary instructions for graduate education in the quality and reliability engineering field. Laboratory facilities and equipment will also be highlighted.

3 - Recent Development of Quality and Reliability Education in Asia
Panelists: Fugee Tsung, Professor, Hong Kong University of Science and Technology, Department of IELM, Hong Kong University of Sci. & Tech., Hong Kong, Hong Kong - PRC, season@ust.hk

As the world becomes flatter, the convergence of technology and events to East Asia has allowed this region to become important part of the global supply chain for services and manufacturing. For that, the quality and reliability profession has made considerable progress in the East Asia region in recent years. This presentation will give an overview of the recent development of quality and reliability education in this region.

4 - Critical Components of a Quality and Reliability Engineering Graduate Program
Panelist: Douglas Montgomery, Professor, Arizona State University, Tempe, AZ, United States of America, doug.montgomery@asu.edu

The critical components of a graduate program in quality and reliability engineering program are discussed. These components include student preparation and prerequisites, core requirements, and elective opportunities. Participation with other campus programs is also discussed. Both on-campus and on-line masters degree programs are described, along with the opportunities and challenges associated with each type of program. The structure of a PhD program is also discussed.

■ SD06

C-Room 24A, Upper Level

Technometrics — Computer Experiments, Tuning and Optimization

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Steinberg, Professor, Tel Aviv University, Department of Statistics and, Operations Research, Tel Aviv, 69978, Israel, dms@post.tau.ac.il

1 - Robust Local Optimization via Hybrid Search and Sequential Monte Carlo
Matthew Taddy, Assistant Professor, University of Chicago Booth School of Business, 5807 South Woodlawn, Chicago, IL, 60605, United States of America, Matt.Taddy@ChicagoBooth.edu

By combining statistical search using tree-based regression models — fit sequentially via particle learning — with pattern search optimization, we are able to perform robust local optimization more efficiently and effectively than using either method alone. The approach is based on the augmentation of local search patterns with location sets generated through improvement prediction, and the improvement criteria can be chosen to suit either deterministic or stochastic objective functions.

2 - Simultaneous Determination of Tuning and Calibration Parameters for Computer Experiments
Gang Han, Research Scientist, H. Lee Moffitt Cancer Center & Research Institute, MRC/BIOSTAT, 12902 Magnolia Drive, Tampa, FL, 33612-9416, United States of America, Gang.Han@moffitt.org, Thomas Santner, Jeremy Rawlinson

Tuning and calibration inputs are set to enhance the representativeness of complex computer codes simulating physical experiments that are too difficult or costly to run. This talk proposes a new methodology to simultaneously set tuning and calibration inputs based on a Bayesian model. Our methodology significantly improves on the current commonly-used method both in an artificial example and in a biomechanical engineering application.

■ SD07

C-Room 24B, Upper Level

Design and Analysis of Life-testing Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Hon Keung Tony Ng, Associate Professor, Southern Methodist University, Department of Statistical Science, 3225 Daniel Ave., Dallas, TX, 75275, United States of America, ngh@mail.smu.edu

1 - Comparing Optimal Sampling Acceptance Plans for Mixed, Type I and Type II Censoring
Jianwei Chen, Assistant Professor, San Diego State University, Department of Mathematics and Statistics, 5500 Campanile Drive, San Diego, CA, 92182, United States of America, jchen@sciences.sdsu.edu

We investigate optimal acceptance sampling plans under Type I, Type II and mixed censoring and establish an optimal Bayes rule for life testing with mixed censoring. An explicit expression of the minimum Bayes risk for a polynomial decision loss function is derived. Optimal acceptance sampling plans under Type I and Type II censoring are obtained. A finite algorithm for searching an optimal sampling plan is provided and an example is used to illustrate the effectiveness of the proposed models.

2 - Robustness of Optimal ALT Plans
Rong Pan, Assistant Professor, Arizona State University, Industrial, Systems & Operations Eng., Tempe, AZ, 85287, United States of America, Rong.Pan@asu.edu, Hon Keung Tony Ng

In this talk, we discuss the model parameter dependency problem that often appears in accelerate life testing (ALT) planning. That is, in order to formulate the optimal test plan, one has to know the values of some model parameters even before the test. These values are typically assigned based on "prior knowledge" and sensitivity analysis is performed around these values afterward. The "prior knowledge" based on sample estimates of previous experiments is also subject to random error.

3 - Parametric Inference for System Lifetime Data with Signatures Available
Hon Keung Tony Ng, Associate Professor, Southern Methodist University, Department of Statistical Science, 3225 Daniel Ave., Dallas, TX, 75275, United States of America, ngh@mail.smu.edu

In this talk, the statistical inference of the lifetime distribution of component based on observing the system lifetimes with signature available is discussed. A general proportional hazard rate model for the lifetime of the components is considered, which includes some commonly used lifetime distributions. Different estimation methods for the proportional parameter are discussed. Monte Carlo simulation study is used to compare the performance of these estimation methods.

4 - Exact Inference for Progressively Type-I Censored Exponential Failure Data
David Han, Assistant Professor, University of Texas at San Antonio, Dept. of Management Sci. and Statistics, One UTSA Circle, San Antonio TX 78249, United States of America, David.Han@utsa.edu, N. Balakrishnan, G. Iliopoulos

In this talk, we consider a progressively Type-I censored life-test under the assumption of exponential distribution. For small to moderate sample sizes, a practical modification is proposed to guarantee a feasible test under this scheme. We then obtain the MLE of the mean parameter and derive its exact sampling distribution under the condition to ensure its existence. Using the exact distribution as well as the asymptotic and parametric bootstrap methods, we then discuss the construction of confidence intervals and their performance is assessed through Monte Carlo simulations.

■ SD08

C-Room 24C, Upper Level

Joint Session DM/HAS: Data Mining and Knowledge Discovery in Healthcare - I

Sponsor: Data Mining & Health Applications
Sponsored Session

Chair: Durai Sundaramoorthi, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu

1 - Early DRG Classifcation of Inpatient Data in Hospitals
Daniel Gartner, PhD student, TUM Business School, TU München, Arcisstr. 21, München, 80333, Germany, daniel.gartner@wi.tum.de, Rainer Kolisch, Rema Padman, Daniel B. Neill

When a patient is discharged from a hospital, Diagnosis-related groups (DRGs) are calculated by using clinical, treatment, and demographic data. In this study we applied machine learning methods to classify DRGs at and after admission. The results show that DRGs can be predicted with higher accuracy than the current approach.

2 - Access Block And Overcrowding In Emergency Departments: A Correlated Hazard Approach
Anurag Sharma, Research Fellow, Centre for Health Economics, Monash University, Bld 75, rm 2102, Monash University, Clayton, VI, 3800, Australia, anurag.sharma@buseco.monash.edu.au, Anthony Harris, Brett Inder

This study models the hazard of wait in the ED as an outcome of a related multi-episode process comprising of three episodes: i) duration of wait from arrival to first seen by doctor, ii) duration of wait from treatment to bed request and iii) duration of wait from bed request to admission.

3 - Physician Performance Modeling in a Healthcare Organization
Lori Pelletier, Worcester Polytechnic Institute, Manufacturing Engineering, 100 Institute Road, Worcester, MA, 01566, United States of America, loripell@wpi.edu, Sharon Johnson, Alan Krinsky, Edward Westrick, Elaine Fontaine, Qi Zhou

Physician measurement is gaining increasing attention as healthcare organizations seek incentives to improve outcomes. A hierarchical composite model was created with multiple measures and domains supporting small sample sizes and reliable measurement across primary care physicians. The physician measurement model was developed using claims data from a large, multi-clinic organization; the methodology provides a foundation for other healthcare organizations to build similar measurement models.

■ SD09

C-Room 25A, Upper Level

Joint Session Applied Probabilty/Queueing: Dynamic Control of Many Server and Parallel Server Systems

Sponsor: Applied Probability & Queueing
Sponsored Session

Chair: Amy Ward, USC, Marshall School of Business, BRI401H, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu

1 - The c mu / theta rule - An Optimal Scheduling Policy in Presence of Abandonment
Rami Atar, Technion, Department of Electrical Engineering, 32000 Haifa, 32000, Israel, atar@ee.technion.ac.il, Chanit Giat, Nahum Shimkin

We will present a simple index priority rule for a multiclass many-server queueing system, and argue that it asymptotically minimizes holding costs as the number of servers grows without bound.

2 - Abandonment vs. Blocking in Many-server Queues: Asymptotic Optimality in the QED Regime
Ananda Weerasinghe, Professor, Department of Mathematics, 396, Carver hall, Iowa State University, Ames, IA, 50011, United States of America, ananda@iastate.edu, Avishai Mandelbaum

A cost minimization problem of a large telephone call center is considered by using a G/M/n/B+M type queueing model. Costs are proportional to queue-length, number of blocked and abandoning customers and the number of idle servers. The queue capacity is the control variable. Using Halfin-Whitt heavy traffic limit, we obtain a diffusion control problem and solve it explicitly. It is used to derve an asymptotically optimal queue capacity for the queueing control problem.

3 - On Dynamic Scheduling of a Parallel Server System with Certain Graph Structure
Vladimir Pesic, vpesic@ucsd.edu, Ruth Williams

Assuming the server-buffer graph associated with a parallel server system has a certain structure, we give sufficient conditions for a least control process to be the optimal solution of the equivalent workload formulation of the approximating Brownian control problem. Under these conditions, we report on some preliminary analysis of a threshold-type policy that we conjecture is asymptotically optimal for the parallel server system.

4 - Dynamic Scheduling of an N-System with Impatient Customers
Samim Ghamami, University of Southern California, 3215 Overland Ave, Apt # 7176, Los Angels, 90034, Los Angeles, CA, 90034, United States of America, ghamami@usc.edu, Amy Ward

We consider a parallel server system known as an N system, in which there are two customer classes and two servers. Customers in both classes are impatient. Our objective is to schedule waiting jobs onto available servers so as to minimize the sum of holding and abandonment costs. We propose a control policy (which differs from Bell-Williams), and show that it is asymptotically optimal in the heavy traffic regime in Bell-Williams.

■ SD10

C-Room 25B, Upper Level

Stochastic Models of Manufacturing and Service Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Ivo Adan, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, iadan@win.tue.nl

1 - Impact of Delay Signals on Ambulance Traffic Operations
Masha Shunko, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, mshunko@andrew.cmu.edu, Alan Scheller-Wolf, Soo-Haeng Cho

Ambulance crews' decisions regarding which hospital to transport patients to is impacted by the crew's expectations about the current delay at candidate hospitals' emergency departments. Hospitals, based on their own incentives, have the ability to influence the crew's expectations by sending real-time delay signals. We model a setting with two competing hospitals, derive their optimal delay signaling strategies, and analyze the impact of these strategies on the system performance.

2 - Synchronized Periodic Admission and Workforce Decisions Under a Lead Time Performance Constraint
N.C Buyukkaramikli, PhD Candidate, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, N.C.Buyukkaramikli@tue.nl, Will Bertrand, Henny van Ooijen

We analyze a system that faces random demand and service requirements which operates under a lead time performance constraint.We first introduce periodic admissions(PA) to the system,which have positive effects upto a period length and have negative effects after that period length.If decisions on the use of contingent workforce are taken at the admission points,further savings can be achieved depending on the service level,cost of contingent workforce,lead time and period length.

3 - Planning of Guaranteed Targeted Display Advertising
John Turner, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, jgt@andrew.cmu.edu

When planning how to serve ads on web pages and in online video games, a common objective is to proportionally spread impressions (ad views) across viewer types as much as capacity constraints allow. We show this objective tends to maximize the number of unique viewers while minimizing variability of service. By using an aggregation heuristic used to solve large transportation problems, we allocate impressions to ad campaigns to satisfy this objective at an appropriate planning granularity.

4 - Aggregate Modeling of Multi-processing Workstations
Ivo Adan, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, iadan@win.tue.nl, Marcel van Vuuren, Pascal Etman, Koos Rooda, Adam Wierman, Ad Kock

To model manufacturing systems consisting of flow lines with finite buffers and parallel servers at an aggregate level, we propose a multi-server station with process times depending on the work in process (WIP). An algorithm is developed to measure the WIP-dependent process times directly from industrial data such as arrival times at and departure times from the manufacturing system. Simulation results show that the aggregate model accurately predicts the mean flow time.

■ SD11

C-Room 25C, Upper Level

Protection of Critical Infrastructure

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: John F (Jack) Keane, Johns Hopkins University/Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Jack.Keane@jhuapl.edu

1 - Optimal Diversion Planning and Protection in Infrastructure Networks
Christopher Cullenbine, PhD Student, Colorado School of Mines, Golden, CO, 80401, United States of America, ccullenb@mines.edu, Alexandra Newman, Kevin Wood

Diversionary requirements arise when planning infrastructure network attacks. The network-diversion problem (NDP) requires identification of a minimum-weight s-t cut that includes at least one "diversion edge." We improve upon a specialized branch-and-bound algorithm for NDP. The ability to divert optimally then enables optimal protection against diversion: we demonstrate how.

2 - How to Assess the Value of Critical Infrastructure
David Alderson, Assistant Professor, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, dlalders@nps.edu, Matthew Carlyle, Gerald Brown

We assess the value of a critical infrastructure system by modeling its function. We assume when system components fail, or are intentionally damaged, the surviving components will be operated to maximize residual function. We quantify the consequence of a disruption in terms of the combined, synergistic ability of surviving components to function as a damaged system. We identify worst-case disruptions by assessing how these components might be maximally damaged by an intelligent adversary.

3 - Critical Infrastructure Inspection Management System (CIIMS)

Jeffery Brush, Johns Hopkins University/Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, jeffery.brush@jhuapl.edu, Stephen Wright

The Critical Infrastructure Inspection Management System (CIIMS) is a software application utilized by aerial borne police officers to collect information on identified critical infrastructure and key resources (CI/KR) for use by intelligence analysts. CIIMS allows state fusion centers to access airborne "collection" assets to inspect CI/KR by creating inspection metrics. These metrics are then sent to CIIMS tablets where they populate the software until the inspection is complete.

4 - Army Research Office - New Decision Sciences Program

Janet H. Spoonamore, PhD Program Manager, Army Research Office, Decision Sciences Program, P.O.Box 1221, Research Triangle Park, NC, 27709, United States of America, janet.spoonamore@us.army.mil

Army Research Office (ARO) announces a new research program which addresses decision sciences - to assist Land Component Commanders in making decisions in complex environments. The goal of this new program is to develop theoretical foundations, models, and algorithms to support timely, robust, near-optimal decision making in highly complex, dynamic systems, operating in uncertain, resource-constrained environments with incomplete information against a competent thinking adversary.

■ SD12

C-Room 26A, Upper Level

Complementarity, Conality, and SDP - Algorithms and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Robert Vanderbei, Professor, Princeton University, Sherrerd Hall, Room 106, Princeton, NJ, 08544, United States of America, rvdb@princeton.EDU

1 - A Disjunctive Programming Approach to LPCC

Bin Yu, Graduate student, Rensselaer Polytechnic Institute, CII5015 Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, 12180, United States of America, yub@rpi.edu, John Mitchell

A linear program with complementarity constraints (LPCC) can be modeled as a disjunctive program. By imposing one pair of disjunctive constraints at a time, we are able to use a cut generating LP to generate a disjunctive cut for the LPCC problem. We present a branch and cut algorithm to globally solve the LPCC problem. The algorithm is able to characterize infeasible and unbounded LPCC problems as well as solve problems with finite optimal value.

2 - Optimization over the Doubly Non-Negative Cone

Akiko Yoshise, Professor, University of Tsukuba, Tsukuba, Ibaraki 305-8573, Ibaraki, Japan, yoshise@sk.tsukuba.ac.jp, Yasukaki Matsukawa

While many studies on semidefinite relaxation for combinatorial optimization problems force the solution matrix to be symmetric and positive semidefinite, we often see that it is meant to be non-negative. We call the set of such matrices the doubly non-negative cone. Aiming to develop new algorithms for solving optimization problems over the cone, we provide some basic properties of the doubly non-negative cone focusing on barrier functions on its interior and its duality.

3 - Solving an Image Deconvolution Problem

Robert Vanderbei, Professor, Princeton University, Sherrerd Hall, Room 106, Princeton, NJ, 08544, United States of America, rvdb@princeton.EDU

A recent paper by A. Leshem shows how high resolution imaging in radio astronomy can be formulated as a block 2x2 semidefinite programming problem. In this talk, I will describe the problem and show how it can be solved efficiently as a convex optimization problem.

4 - Interior-Point Methods for MPECs

Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu, David Shanno, Arun Sen

Penalty approaches for interior-point methods have been favored to handle the unbounded multipliers when solving mathematical programs with equilibrium constraints (MPECs). Even without this remedy, interior-point methods are quite successful at solving many MPECs in practice. In this talk, we will present a globally convergent interior-point method which uses a penalty approach and analyze its numerical performance on MPECs. Comparisons to non-penalty interior-point methods will be provided.

■ SD13

C-Room 26B, Upper Level

Social Network Analysis

Sponsor: Computing Society
Sponsored Session

Chair: Matthew Galati, Optimization Interface Lead, SAS Institute, Philadelphia Regional Office, Suite 201, 1400 Morris Drive, Chesterbrook, PA, 19087, United States of America, matthew.galati@sas.com

1 - ORA: A Network Analysis Tool

Terrill Frantz, Carnegie Mellon University, ISR/SCS 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, terrill@org-sim.com, Kathleen Carley

ORA is a socio-technical network analysis tool used for the analysis of organizations, according to the relationships among personnel, knowledge, resources, and tasks. These entities and relationships are reflected by over 100 network measures. ORA is a network visualizer and can generate formatted reports viewable on screen or stored in data files. ORA works with multiple data formats to allow interoperability with other network and statistical analysis packages.

2 - Algorithms for Maximum K-plexes in Power-law Graphs

Balabhaskar Balasundaram, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, baski.balasundaram@okstate.edu, Sergiy Butenko

A k-plex is a graph-theoretic clique relaxation introduced in social network analysis for finding cohesive subgroups. In this talk we discuss exact algorithms for finding a largest k-plex in arbitrary graphs. Power-law degree distribution is frequently observed in social and biological networks, and the problem is solved to optimality on such instances by a suitable combination of preprocessing and an exact algorithm.

3 - Influence of Social Networks on Physician Adoption of Technological Innovations

Rema Padman, Professor, Heinz College, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, rpadman@cmu.edu, Kai Zheng, Michael Johnson, David Krackhardt

We developed a survey to delineate three types of physician social networks in an ambulatory primary care practice: professional, friendship, and perceived influence on intention to use technology, to study how they relate to an individual physician's usage of an electronic health records system. The results show that social influence affecting technology adoption behavior by physicians is primarily conveyed through friendship interactions rather than professional relationships.

4 - Community Identification via Structured Concurrent Flow

Richard Goodrum, Lecturer, Department of Computer Science and Engineering, University of North Texas, P.O. Box 311366, Denton, TX, 76203-1366, United States of America, Richard.Goodrum@unt.edu, David Matula, Eli Olinick

We present a new divisive algorithm for community identification in social networks. The algorithm focuses on a hierarchy of flow levels and neither removes edges prematurely nor ignores previously absorbed capacity while dividing communities. We compare and contrast the community structures identified by our algorithm with previously proposed approaches across social network data from the literature.

5 - On the Topology of Large Clusters and Duality of Cuts and Paths

Patrick Plewes, Southern Methodist University, 1415 Kaitlyn Ln, Keller, TX, 76248, United States of America, pplewes@smu.edu

Good community structure analysis of social networks can be obtained by partitioning in a succession of sparsest cuts (Mann, et al). We focus on two aspects of this succession. The first is that of large clusters ‚Ä' the topology of clusters as we progress through the first cuts in a hierarchy. The second aspect of focus is the duality of cuts and paths. The interplay of the flow paths and the cut hierarchy provide for interesting visualization of the clustering of vertices in social networks.

■ SD14

C-Room 27A, Upper Level

Software for OR/MS I

Sponsor: Computing Society
Sponsored Session

Chair: Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

1 - New Features in Xpress-Mosel

Alkis Vazacopoulos, Vice President, FICO, 202 Parkway, Harrington Park, NJ, 07640, United States of America, alkisvazacopoulos@fico.com

Xpress-Mosel allows you to formulate your optimization problem, solve it with a suitable solver engine, and analyze the solution, using a fully-functional programming language specifically designed for the purpose. In this talk we will present new very innovative features Of Xpress-Mosel that allows the user to solve a wide range of complicated optimization problems.

2 - Extending NIDR for GUI Preparation of Program Input

David M. Gay, Sandia National Labs, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, dmgay@sandia.gov

DAKOTA is a program for uncertainty quantification and optimization of separately specified problems. To simplify maintenance, we developed a facility, NIDR, for processing DAKOTA input in a way independent of DAKOTA and meant to be useful in other contexts. A graphical interface, JAGUAR, is being developed for DAKOTA. To help this effort, we have extended NIDR to convey extra details and documentation pointers to JAGUAR. This talk briefly describes DAKOTA, NIDR, and extensions for JAGUAR.

3 - Using IBM ILOG OPL as a Development/Debugging Tool in Creating CPLEX and/or CP Models

Carol Tretkoff, Technical Account Manager, IBM, 9662 Masterworks Drive, Vienna, VA, 22181, United States of America, tretkoff@us.ibm.com

IBM ILOG Optimization Decision Manager (ODM) is available as an add-on to OPL Development Studio; it can be used effectively to speed up the process of creating and debugging optimization models using CPLEX and/or CP Optimizer. We will provide several examples of how prototype generation, data visualization, and scenario editing can be useful during the model development process.

■ SD15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Microsoft Solver Foundation

John Oberon, Director of Program Management, Microsoft, One Microsoft Way, 4.2194, Redmond, WA, 98052, United States of America, joberon@microsoft.com, Nathan Brixius, Min Wei

Solver Foundation is a pure, managed code runtime for mathematical programming, modeling, and optimization. This session will focus on our computational integer programming effort. Our MIP solution is a branch and cut solver based on Dual Simplex, and is designed to enable 64bit and multi-core computation environments. We will go into some level of detail around advanced presolve, Gomory mixed integer cuts, mixed integer rounding cuts, and local search heuristics.

2 - Palisade Corp. - Decision Tools Suite Software Introduction

Stephan Beeusaert, Palisade Corp., 798 Cascadilla Street, Ithaca, NY, 14850, United States of America, sbeeusaert@palisade.com

Palisade's DecisionTools Suite includes 7 software packages that can be used by a wide variety of departments and individuals within any organization, to better assess risk and make well-informed decisions. This comprehensive example demonstrates how all the components of the Suite can be used together to assess the likelihood of success of a new product launch, determine critical variables to limit risk exposure, optimize the inclusion of the new product into existing manufacturing facilities, and plan for the expansion of both production and distribution networks.

■ SD16

C-Room 28A, Upper Level

Social Networking

Sponsor: Information Systems
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, N231 BCC, East Lansing, MI, 48824, United States of America, sambamurthy@bus.msu.edu

1 - Social Networks and the Diffusion of User-Generated Content: Evidence From YouTube

Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu, Jeong-ha Oh, Yong Tan

Using a unique data set of video information and user information collected from YouTube, we analyze content diffusion in online social networks. Econometrically, the problem in identifying social influence is that individuals' choices depend in great part on the choices of other individuals, referred to as the 'reflection problem'. Another problem in identification is to distinguish between social contagion and user heterogeneity in the diffusion process.

2 - The Debate on Net Neutrality: A Policy Perspective

Hsing Cheng, University of Florida, hkcheng@ufl.edu, Subhajyoti Bandyopadhyay, Hong Guo

The principle of net neutrality is under fierce debate. We find that if the principle of net neutrality is abolished, the broadband service provider stands to gain from the arrangement. Content providers are left worse off. Under net neutrality, the broadband service provider always invests in broadband infrastructure at the socially optimal level, but either under- or over-invests in infrastructure capacity in the absence of net neutrality.

3 - Blog, Blogger, and the Firm: Can Negative Posts by Employees Benefit Firms?

Rohit Aggarwal, Assistant Professor, University of Utah, David Eccles School of Business, University of Utah, Salt Lake City, UT, 84113, United States of America, rohit.aggarwal@business.utah.edu, Ram Gopal, Ramesh Sankaranarayanan

The business world is beginning to realize that employee blogs can cast a firm in either a positive or a negative light. Paradoxically, under certain conditions negative postings by employees can actually help the overall reputation of the firm. The explanation for this is that readers perceive an employee blogger to be honest and helpful when they read negative posts on the blog, and recommend the blog more to their friends, who will then also be exposed to the positive posts on the blog.

■ SD17

C-Room 28B, Upper Level

Internet Based Information Intermediaries

Sponsor: Information Systems
Sponsored Session

Chair: Animesh Animesh, McGill University, 1001 Sherbrooke St. W., Montreal, QC, H3A 1G5, Canada, animesh.animesh@mcgill.ca

Co-Chair: Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180-3590, United States of America, kuruzj@rpi.edu

1 - Identifying and Overcoming Self-Selection Biases in Online Product Reviews

Paul Pavlou, Associate Professor of Information Systems, Marketing, and Management, Temple University, 1810 N. 13th St., Philadelphia, PA, United States of America, pavlou@temple.edu, Nan Hu, Jennifer Zheng

Online product reviews help consumers infer product quality, and the mean rating is often used as a proxy for quality. However, we identify two self-selection biases that may render the mean rating a biased estimator that cannot be used to either infer a product's own quality in absolute terms or to compare relative quality across products.

2 - Recommender Systems and their Effects on Consumers: The Fragmentation Debate

Kartik Hosanagar, Professor, The Wharton School, United States of America, kartikh@wharton.upenn.edu

Recommender systems help consumers find products that best match their interests. This ability to focus on one's interests has spawned criticism that recommenders will fragment consumers, i.e. cause consumers to have less in common with one another. We present an empirical study and find that users become more similar to one another in terms of their purchases. Consumers have more in common both because they change what they buy and also because they simply purchase more.

3 - Retailer Resources and the Use of Infomediaries
Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180-3590, United States of America, kuruzj@rpi.edu

Information about prospective customers is an important input into the personal selling and direct marketing processes. Specialized online sites know as referral infomediaries provide organizations with the opportunity to purchase prospect information directly. In this research, we examine the role of firms'resources in driving both the investment in prospective customer information (i.e., referrals) and the sales resulting from these investments.

4 - A Model of Intelligent Recommenders: The Role of Sponsored Result
Jane Feng, Assistant Professor, University of Florida, 360 Stuzin Hall, Gainesville, FL, 32611, United States of America, jane.feng@cba.ufl.edu, Hemant Bhargava

We develop an economic model of sponsored search on intelligent recommenders, in a setting where consumers cannot a priori discern low and high quality merchants. We find that an intelligent recommender not only makes consumers better-informed, but also causes merchants to modify their price-advertising strategies that affects consumer welfare.

■ SD18

C-Room 28C, Upper Level

Recent Developments in Vehicle Routing

Sponsor: Computing Society
Sponsored Session

Chair: Ed Wasil, American University, 4400 Massachusetts Ave, NW, Washington, DC, 20016, United States of America, ewasil@american.edu

Co-Chair: Bruce Golden, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, bgolden@rhsmith.umd.edu

1 - Vehicle Routing with Compartments
Ulrich Derigs, Universiy of Cologne, Department of IS and OR, Cologne, Germany, derigs@informatik.uni-koeln.de, Michael Piesche, Ulrich Vogel

We present a suite of heuristic components for solving the vehicle routing problem with compartments. The suite covers a broad range of alternative approaches for construction, local search, large neighborhood search and meta-heuristics. We identify the best algorithmic setup as well as essential components for achieving high solution quality. A comparison on instances taken from the literature reveals that our approach is able to produce better solutions on most instances.

2 - Routing Models for Humanitarian Logistics
Kiran Panchamgam, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, kpanch@gmail.com, Bruce Golden, Ed Wasil

We seek to design efficient delivery routes for humanitarian relief operations. In particular, mathematical programming models are developed to determine routes for the delivery of emergency supplies to numerous locations based upon demand and urgency. The routes are evaluated with respect to performance metrics relevant to humanitarian logistics.

3 - Incorporating Operational Complexity in the Period Vehicle Routing Problem
Karen Smilowitz, Associate Professor, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, ksmilowitz@northwestern.edu, Tingting Jiang, Maciek Nowak

We explore the addition of operational complexity to the Period Vehicle Routing Problem (PVRP). The PVRP extends the vehicle routing problem by serving customers according to set visit frequencies over a time period. When routes operate over multiple days, issues of operational complexity arise. Operational complexity captures the difficulty of implementing a solution for service providers and customers. We add complexity to the PVRP and evaluate the impact of complexity on solutions.

4 - An Integer Programming-based Heuristic for Solving the Period Vehicle Routing Problem
Damon Gulczynski, University of Maryland, Department of Mathematics, College Park, MD, 20742, United States of America, damon@math.umd.edu, Bruce Golden, Ed Wasil

We describe a heuristic that uses an integer program to solve the period vehicle routing problem (PVRP). Our heuristic produces solutions that are competitive with the best results reported in the literature. We consider a variant of the PVRP that includes a constraint motivated by routing practice and adapt our heuristic to solve this new variant.

■ SD19

C-Room 28D, Upper Level

Advances in Network Equilibrium Models II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Marco Nie, Assistant Professor, Northwestern University, Evanston, United States of America, y-nie@northwestern.edu

1 - Domain Distributed Dynamic Traffic Assignment Model for Mega-Scale Problems
Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Jorge Villalobos, Pitu Mirchandani

Scalable, multi-computational capabilities are required to model mega-scale traffic networks. A computationally effective network partitioning method as well as a Recurring On-line Load Balance algorithm (ROLB) have been developed. This talk presents the model algorithmic structure and computational results.

2 - Equilibrium Analysis of Macroscopic Traffic Oscillations
Marco Nie, Assistant Professor, Northwestern University, Evanston, United States of America, y-nie@northwestern.edu

This paper studies under what conditions traffic oscillations may be initiated and propagated in a traffic stream. We show that periodic traffic oscillations do not arise from Wardrop equilibria or Boston equilibria. However, periodic oscillations are likely to emerge when 1) transitions between stable and unstable equilibria take place, and more importantly, 2) drivers make decisions based on out-of-date information of traffic conditions.

■ SD20

C-Room 28E, Upper Level

Delivering Humanitarian Aid

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Monica Villarreal, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, monica.v@gatech.edu

1 - Transportation Mode Decision Making in Humanitarian Supply Chains
Lesley Strawderman, Assistant Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, strawderman@ise.msstate.edu, Russ Williams, Han Zhang, Burak Eksioglu

The purpose of this study is to describe the use of intermodal transportation in disaster relief operations, including the amount of intermodal operations, factors impacting mode selection, and frequency of use for different modes. An online survey quantifying transportation modes decision making factors and modes utilization frequencies was completed by 145 disaster relief personnel. Detailed results will be presented, along with directions for implementation and future work.

2 - Equity Considerations in Relief Routing
Michael Huang, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, Michael-Huang@u.northwestern.edu, Burcu Balcik, Karen Smilowitz

We study the effects of routing decisions on equitable service provision in disaster relief. We explore the implications of different objectives on the performance (efficiency, effectiveness and equity) of aid distribution. We develop a formulation and a solution approach and compare the solutions obtained with the different objectives. We present computational analysis with a set of problem instances that capture a variety of network structures.

3 - Debris Clearance During Disaster Response Operations
Jose Antonio Carbajal, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, acarbajal@gatech.edu, Pinar Keskinocak, Monica Villarreal, Ozlem Ergun

Debris is the waste resulting from a disaster and, according to FEMA, debris removal operations account for approximately 27% of the disaster recovery costs. We have identified the main activities to perform during each stage of a debris management plan and developed an MIP formulation for the debris collection problem right after a disaster strikes. We investigate the performance of several solution methodologies and present computational results on a series of test instances.

■ SD21

C-Room 30B, Upper Level

Traffic Simulation and Modeling

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Sharif Melouk, The University of Alabama, smelouk@cba.ua.edu

1 - A Day-to-day Traffic Dynamic Model in Discrete/Continuum Transportation Networks

Xiaolei Guo, University of Minnesota, guoxl@umn.edu, Henry Liu

A discrete/continuum transportation network consists of a discrete link-node freeway network and a two-dimensional continuum of dense surface streets, with the freeway network superimposed on the continuum and connected with it at a limited number of points (freeway ramps). We propose a day-to-day traffic dynamic model suitable for this discrete/continuum representation of urban transportation networks, and provide numerical examples to demonstrate the effectiveness of our model.

2 - Stability Analysis of Traffic Trajectory Data

Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B156, 205 N. Mathews Avenue, Civil & Environmental Engineering, Urbana, IL, 61801, United States of America, nourbak1@illinois.edu, Yanfeng Ouyang, Xiaopeng Li

The stability analysis of car-following models is seldom verified with empirical data. This study proposes stability measures for traffic trajectory data, and analyzes stability characteristics of field data. The analysis results are used to calibrate microscopic behaviors of car-following models.

3 - Using Simulation Optimization to Mitigate Traffic Congestion

Sharif Melouk, The University of Alabama, Culverhouse College of Commerce,smelouk@cba.ua.edu, Christopher Armbrester, Burcu Keskin

Traffic congestion has grown considerably in the United States over the past 20 years. In this research, we develop a robust decision support tool based on simulation optimization to evaluate and recommend congestion mitigation strategies to transportation system decision-makers. A tabu search-based optimizer determines different network design strategies on the road network while a traffic simulator evaluates the goodness of fit. The tool is tested with real-world traffic data.

■ SD22

C-Room 30C, Upper Level

Transportation Surveillance and Traveler Information

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Xiaopeng Li, University of Illinois at Urbana-Champaign, 205 North Mathews Ave, B156, Urbana, IL, 61801-2352, United States of America, li28@uiuc.edu

1 - Traffic Forecast in a Stochastic Networks with Incident Risks

Yupo Chan, Professor, University of Arkansas at Little Rock, Department of Systems Engineering, Little Rock, AR, 72204, yxchan@ualr.edu, Adeyemi Fowe

To support Advanced Traveler Information System, we forecast traffic based on real-time data acquisition and interpolation. Specifically, we present a new mathematical model to estimate network traffic over time based on limited sensor readings. Of specific interest is the exploitation of spatial properties inherent in a network, and the use of such short-term traffic forecast to estimate time-dependent incident probabilities.

2 - Urban Tomography for Security in Transportation Environments: Smartphones as Embedded Networked Vide

Moo-Ryong Ra, mra@usc.edu, Martin Krieger, Ramesh Govindan, Jeongyeup Paek

Law-enforcement personnel are now using multiple video-smartphones for security and intelligence at a major transportation site in the Los Angeles region. We will report on the system and how it is used in practice. The smartphones' connectivity allow for automatic uploading of time/GPS-tagged videos, so creating multi-aspectival records of events in urban places. Challenges include energy/battery constraints and interface design to make the video corpus readily usable.

3 - How Does Inter-and Intra-Personal Variation of Value of Time Influence the Evaluation of Transportation

Lin Qiu, Planning Analyst, Wilbur Smith Associates, Fairfax, VA, lin.w.qiu@gmail.com, Lei Zhang

Value of time (VOT) varies across individuals. The distributions of inter- and intra-personal VOT are likely to be asymmetric and skewed. This paper quantifies the degree to which the use of a single average VOT for all individuals at all times bias the efficiency and equity analysis of transportation projects and policies, especially those sensitive to VOT (e.g. congestion pricing, managed lanes, and modal improvements).

4 - Reliable Sensor Location for Network Traffic Surveillance

Xiaopeng Li, University of Illinois at Urbana-Champaign, 205 North Mathews Ave, B156, Urbana, IL, 61801-2352, United States of America, li28@uiuc.edu, Yanfeng Ouyang

This†study establishes a reliable sensor location design framework for traffic surveillance where sensors are subject to probabilistic failures. The objective is to maximize the total expected benefits from traffic flow inspection and O/D travel times estimation, under normal and failure scenarios. Numerical examples demonstrate the application of the proposed model and insights are drawn.

■ SD23

C-Room 30D, Upper Level

DIME/PMESII Modeling Issues

Sponsor: Military Applications Society
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Understanding the Dynamic Information Landscape of Violent Ideologies and Religious Extremism over Time

Dipak Gupta, Professor, San Diego State University, 5500 Campanile Dr., San Diego, CA, 92182, United States of America, dgupta@mail.sdsu.edu, Ming-Hsiang Tsou

In this project, we propose an innovative method for identifying both the semantic and space-time dimensions of the spread of violent ideologies, specifically Islamic extremism.

2 - VV&A for Human, Social, Cultural Behavior (HSCB) Models

Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

VV&A is required for models within DoD. Many see it as a requirement to be checked-off or as an attempt to discredit their model. Given the large uncertainties in the basic social theories, there is fear of VV&A within the HSCB domain. However, the proper application of VV&A is the generation of knowledge of the model. Arguably, this knowledge is more important in an uncertain domain than in a well-understood domain. The application of VV&A to HSCB models, while difficult, is not impossible.

3 - Political Effectiveness, Provincial Perspective on Terrorism, Stability and Growth

Mark Abdollahian, Professor, Claremont Graduate University, 170 East 10th Street, Claremont, CA, 91711, United States of America, maa@sentiagroup.com, Jacek Kugler, Marina Arbetman-Rabinowitz, Kyungkook Kang

Political effectiveness of governments and oppositions constrains policy implementation. Works on political extraction, reach and allocations determine which political actions can succeed. The general equilibrium POFED 2008 approach anticipates stability, terrorist success, policy implementation by the government or opposition, and long term economic growth and demographic change. The forecasted policy actions disclose how to deter terrorists. Sudan and Pakistan cases are presented.

■ SD24

C-Room 30E, Upper Level

OR/MS for Enterprise Transformation II

Sponsor: Military Applications Society
Sponsored Session

Chair: B.J. Thornburg, President, Management Analysis Technologies, Inc, 5 Pritchard Court, Stafford, VA, 22554, United States of America, thornbj@mat-inc.net

Co-Chair: Greg Parlier, SAIC, 255 Avian Lane, Madison, AL, 35758, United States of America, greg.h.parlier@saic.com

1 - Strategic Measurement, Assessment and Reporting Tool SMART

William Wallace, Strategic Assessments Branch Chief, U.S. Africa Command, CMR 489 Box 1014, Stuttgart/Mohringen, APO, AE, 09751, Germany, william.wallace@africom.mil

US Africa Command must provide the Secretary of Defense an annual assessment of the Command's theater objectives and strategic effects. The Strategic Capabilities and Assessment Division mapped out a methodology to assess the Theater Campaign Plan, including numerous programs and activities

inherited from the other COCOMS. To conduct this assessment the Division is developing a process and SMART. This briefing describes the progress to date, and provides some example assessments.

2 - Effective and Efficient Simulation
Tom Donnelly, SAS Institute Inc., 27 Farmingdale Ln, Newark, DE, 19711-4392, United States of America, tom.donnelly@jmp.com

Design of Experiments (DOE) methods for efficiently extracting the most useful information from simulations will be demonstrated. A sequential design approach will show how to run the fewest simulations needed to do sensitivity analysis or to develop a fast-running surrogate model. Solutions will include the application of both traditional DOE to discrete event and agent-based simulations and space-filling designs to more complex physics-based simulations using Computational Fluids Dynamics.

3 - Legacy Systems Replacement Paradigm and ERP Systems
Tim Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, 422 Mahan Hall, West Point, NY, 10996, United States of America, timothy.elkins@usma.edu, Matt Dabkowski

Emphasis is being placed on improving the government's IT systems in order to better run the business of government. However, replacement seems to have been the paradigm. As a result, the larger set of functionalities of an ERP system have been sectioned out to align with legacy functions and in the process the goodness of an ERP system lost. We assesses the value provided by the implementation of multiple, fragmented ERP instances versus several alternatives, including a single instance.

4 - Enterprise Archtecture Influence on Endogenous Stakeholder-Value Creation Influence
Doug Matty, LTC, MIT / US Army, dmatty@mit.edu, Deborah Nightingale

The emerging field of engineering systems is being focused on the domain of extended enterprises. The interaction of the enterprise stakeholders and value creation are endogenous to the enterprise architecture. This paper presents preliminary findings of enterprise architecture attributes, their influence on stakeholder salience and value creation. These results are based on mixed methods research using both qualitative and quantitative methods.

■ SD25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Scheduling and Sequencing in Air Transportation

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: John-Paul Clarke, Associate Professor, Georgia Institute of Technology, School of Aerospace Engineering, 270 Ferst Drive NW, Atlanta, GA, 30332, United States of America, johnpaul@gatech.edu

1 - Joint Optimization of Aircraft Arrival and Departure Schedules
Ahmed Ghoniem, aghoniem@som.umass.edu, Hojong Baik, Hanif D. Sherali, Antonio Trani

We examine the sequencing of arrivals and departures for runway operations in the Terminal Management Area. The problem is modeled as a variant of the TSP with time-windows. Preprocessing strategies and an application of the Reformulation-Linearization Technique are investigated in order to derive a tighter representation. Computational results are presented.

2 - A Fuel Optimal and Reduced Controller Workload Optimization Model for Conflict Resolution
Adan Vela, Georgia Institute of Technology, 279 Ferst Drive, Atlanta, GA, United States of America, aevela@gatech.edu, Senay Solak

In this study, we consider the air traffic conflict resolution problem in regards to controller workload. An optimization model for determining the maneuvers that minimize fuel costs for a fixed number of aircraft commands, is compared to the L-1 norm approximation of the problem. The L-1 approximation, is similar to the previous formulation, however the number of aircraft commands is a free variable, and appended to the cost is the weighted L-1 norm of all aircraft maneuvers.

3 - Optimization of Airport Taxiway Operations
Hanbong Lee, Graduate Student, Massachusetts Institure of Technology, 77 Massachusetts Avenue, 35-217, Cambridge, MA, 02139, United States of America, hanbong@MIT.EDU, Hamsa Balakrishnan

This talk describes an approach for optimizing taxiway operations to minimize aircraft taxi times and emissions at congested airports. The integer programming-based approach is illustrated using a study at Detroit airport. Operations are optimized by utilizing different control points on the airport surface, including gates and various intersections on the taxiway system. Results from a simulation-based effort to assess the benefits of such surface optimization techniques are also presented.

4 - Rapidly Generated Complexity Maps: Principles and Applications
Erwan Salaun, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, United States of America, erwan.salaun@gatech.edu, Adan Vela

We present a methodology for rapidly generating complexity maps for various configurations to determine a measure of airspace capacity. The complexity map is based on analytical expressions, validated through simulations, of aircraft maneuver distributions between two flows at an intersection under automated conflict resolution. By synthesizing the results to the sector level, complexity is expressed as a function of the overlapping areas of these distributions for multiple intersecting flows.

■ SD26

C-Room 31B, Upper Level

Panel Discussion: Aviation Applications Section Industry Panel

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

1 - Aviation Applications Section Industry Panel
Moderator: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

Major tarmac delays (on the order of several hours), although statistically rare, nonetheless do occur, with tremendous impact on the affected passengers. More commonly, shorter but still inconvenient delays occur on a regular basis as a result of airport and airspace congestion. Issues such as the Passenger Bill of Rights and slot controls in the NY area are currently being debated, both in Washington and in the press, with high emotion and anecdotal evidence capturing most of the attention. The operations research community has a tremendous opportunity to play a role in these debates, bringing analysis and reason to such charged discussions. We present a panel-led discussion of the causes, impacts, and opportunities for improving these key challenges.

■ SD27

C-Room 31C, Upper Level

Simulation and Performance Analysis of Call Center Processes

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Vijay Mehrotra, Associate Professor, University of San Francisco, School of Business and Management, 2130 Fulton St., San Francisco, CA, 94117-1080, United States of America, drvijay@sbcglobal.net

1 - Hiring and Retention of Heterogeneous Workers
Alessandro Arlotto, OPIM Dept - Wharton - Penn, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States of America, alear@wharton.upenn.edu, Stephen Chick, Noah Gans

Motivated by preliminary results on call-center data, we study how learning a ects worker heterogeneity and, as a consequence, how this influences hiring and retention decisions. We propose a screening method that uses an infinite-armed-bandit model in which each arm (i.e. each potential hiree) has a random lifetime, and we study its properties.

2 - An Optimization-simulation Approach for Assigning Work to Agents
Geoff Ryder, Ph.D. Candidate, UC-Santa Cruz, 4190 Sophia Way, San Jose, CA, 95134, United States of America, gryder@gmail.com, Kevin Ross

We describe a two-step, optimization and simulation approach to assigning work to call center agents who learn by doing. A nonlinear program with nonlinear constraints generates routing targets for agents to maximize a utility function of the total skill level at the center. We then describe the results from using the solver's outputs as targets in Monte Carlo simulations of routing rules. The model parameters used by the solver and the simulator are taken from empirical data.

3 - Empirical Analysis of Skill Based Routing in Call Centers: A Queueing-Science Perspective

Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu, Pablo Liberman, Avishai Mandelbaum

In this study we take an empirical view of the call center as a network of queues. We analyze transactional data from three different call centers and perform a detailed analysis of this data. Our objectives are two-fold: (a) validate or refute some of the prevalent assumptions that are made in the literature on Skills-Based Routing (SBR) and (b) identify phenomena that have not been considered in that literature but that seem central to the operations of the call center.

4 - Real-Time Delay Announcements in Call Centers

Rouba Ibrahim, Columbia University, 500 West 120th Street 313 Mudd, New York, NY, 10027, United States of America, rei2101@columbia.edu, Ward Whitt

We develop new improved real-time delay estimators in many-server service systems with time-varying arrivals and customer abandonment. These delay estimators may be used to make delay announcements. Our estimators effectively cope with time-varying arrivals together with non-exponential service-time and abandonment-time distributions, which are often observed in practice. We use computer simulation to verify that our proposed estimators outperform several natural alternatives.

■ SD28

H-Room 500, Fifth Floor

Strategic Consumer Behavior in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, United States of America, c.maglaras@columbia.edu

1 - Revenue Maximization in a Market Where Buyers Post Their Price

Nur Ayvaz, Columbia University, IE & OR department Rm. 313 Mudd Building, 500 W 120th street, New York, NY, 10027, United States of America, na2191@columbia.edu, Soulaymane Kachani, Costis Maglaras

We study a revenue management problem for a monopolist that operates in a setting where the buyers strategically post their prices (BPP) that the seller has to accept or reject. The goal is to maximize the seller's revenues in a variety of informational settings. Our motivating application is the real-estate developer's revenue maximization problem for multi-unit residential projects. The model, results and insights are applicable in many other settings.

2 - Distributed Learning in Revenue Management

Omar Besbes, Columbia University, Graduate School of Business, 3022 Broadway, Uris Hall, New York, 10027, United States of America, ob2105@columbia.edu, Johannes Horner, Gad Allon

We consider a revenue maximizing retailer with multiple points of sale (POS) facing an uncertain demand environment. We investigate the impact of information pooling across POSs on the depth of learning of an optimal policy as well as how learning is distributed as a function of the remaining inventories.

3 - Consumer Stockpiling and Dynamic Pricing

Xuanming Su, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

For products with stable consumption patterns (e.g., household goods), strategic consumers can stock up for future consumption. We study the firm's dynamic pricing problem and characterize the optimal pricing strategies. We identify conditions under which it is optimal for firms to use periodic price promotions to price discriminate between different consumers.

■ SD29

H-Room 501, Fifth Floor

Energy, Environment and Regulation

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Yihsu Chen, University of California, Merced, 5200 N. Lake Rd, Merced, CA, 95343, United States of America, yihsu.chen@ucmerced.edu

1 - Oligopolistic Electricity Market Simulation with Massive Wind-based Generation Penetration

Julian Barquin, Comillas University, Aberto Aguilera 23, Madrid, 28015, Spain, julian.barquin@iit.upcomillas.es, Efraim Centeno, Alvaro Lopez-Pena, Miguel Vazquez

The stupendous growth of wind-based electricity generation and its intermittent character is causing that the remaining generation technologies operate very differently than in the past. This fact requires the development of new simulation models, and in particular of those that intend to represent the strategic interaction between the agents. We introduce a model that aims to fulfill this task based on a conjectural price response representation of the agents' behavior.

2 - Analysis of Market Penetration of Renewables in an Uncertain and Carbon Constrained World

Ozge Kaplan, Research Fellow, US Environmental Protection Agency, 109 TW Alexander Dr., Mail Drop: E305-02, Research Triangle Park, NC, 27711, United States of America, Kaplan.Ozge@epamail.epa.gov

This study investigates how U.S. energy system might evolve over time under the effects of the uncertainty in the climate-change policy decisions, fossil fuel supply and prices, and availability and cost of renewable energy technologies. Two-staged stochastic decision making methods in U.S. EPA's MARKAL modeling system will be utilized to generate various scenarios under uncertain and carbon constrained world.

3 - Investment Decision under Tradable Permits and Carbon Tax Policies

Chung-li Tseng, University of New South Wales, Australian School of Business, Sydney, Australia, c.tseng@unsw.edu.au

Two market-based instruments are commonly considered by policy makers to control CO2 emissions: tradable permits and tax. Whereas the level of tax is fixed and decided by authorities, tradable permits price is uncertain and driven by the market dynamics. Both policies are market-based, but offer firms different long-run investment incentives. This talk presents preliminary results of optimal investment decisions when a firm faces these two distant but related instruments using real options.

4 - Metamodeling of Integrated Planning Model Runs for Prediction and Tradeoff Analysis

Jeremy Hargreaves, The Johns Hopkins University, 3400 N Charles St, Ames Hall, Rm 313, Baltimore, MD, 21218, United States of America, jhargreaves@jhu.edu, Elliot Lieberman, Benjamin Hobbs

Methods are developed to interpolate, within constrained input variable ranges, outputs of the Integrated Planning Model (IPM) - a large scale LP model of the US power industry used by the EPA. Statistical modeling techniques are adapted to fit the data from previous model runs using prior knowledge of model structure. Using an LP approach, bounds on output values are obtained when outputs are convex functions of input variables.

5 - Modeling Biofuel Input Costs in the National Energy Modeling System (NEMS)

Michael Cole, Operations Research Analyst, Energy Information Administration, 1000 Independence Ave., SW, Washington, DC, 20585, United States of America, Michael.Cole@eia.doe.gov

Biofuels such as ethanol and biodiesel will play an important role in the U.S. energy economy as we strive to increase use of renewable fuels, reduce imported oil, and reduce emission of greenhouse gases. This presentation will discuss how biofuel input costs, such as feedstock costs, are modeled in NEMS. The Energy Information Administration, part of the U.S. Dept of Energy, uses NEMS to construct the widely-referenced Annual Energy Outlook and to answer requests for analysis from Congress.

■ SD30

H-Room 502, Fifth Floor

Forestry II: Reserve Site Selection

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Habitat Reserve Selection for Territorial Disperser Species
Bala Krishnamoorthy, Washington State University, Pullman, WA, United States of America, kbala@wsu.edu, Natalie Baerlocher, David Allen

We study the problem of selecting habitat reserve areas to support territorial disperser species, such as the Northern Spotted Owl. We develop a population predictive index (PPI) function to estimate the occupancies of the species in patches of a habitat landscape. The decisions of which patch is to be sustained and which cleared from among candidate ones is modeled as a non-linear integer program (IP) that maximizes the overall PPI. We solve piecewise-linear versions of this IP.

2 - Modeling Useful Habitat with the Anti-covering Location Problem
Richard Church, Professor, Department of Geography, University of California Santa Barbara, Santa Barbara, United States of America, church@geog.ucsb.edu, Matt Niblett

In this paper we show how the anti-covering location problem can be used to model the amount of useful habitat of a territorial species. This model is applied to a region of the Sierra Nevada Mountains to estimate the habitat of the California Spotted Owl. Technical issues of how the model is solved for a very large data set are covered and both heuristic and optimal approaches are explored.

3 - Dynamic Reserve Selection: Modeling the Land Price Feedback Effect in Strategic Land Retentions
Sandor Toth, College of Forest Resources, University of Washington, Seattle, WA, United States of America, toths@u.washington.edu, Luke Rogers, Robert Haight

Urban growth compromises open space and ecosystem functions. Reserve selection models to aid open space protection assume that acquisitions have no impact on land prices outside the reserves. Our proposed optimization model relaxes this assumption and accounts for land price feedback effects that might arise in markets where conservation acquisitions compete with development. The mechanics of the approach will be illustrated in real land retention contexts in Washington State, USA.

4 - Endogenous Price Effects in Dynamic Conservation Reserve Site Selection: A MIP Approach
Hayri Onal, University of Illinois, Urbana-Champaign, IL, United States of America, h-onal@illinois.edu, Sahan Dissanayake

Land values around conservation reserves increase particularly because of the demand for urban development. We present a 2-period MIP model for reserve site selection incorporating spatial and ecological criteria along with endogenous price feedback effects inherent in the problem. We compare the empirical results with the results of an iterative static model.

■ SD31

H-Room 503, Fifth Floor

The Revenue Management-Marketing Interface

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Wei Ke, Columbia University, 226 W 97th St, Apt 5D, New York, NY, 10025, United States of America, wke10@gsb.columbia.edu

1 - Case Study in Causal Demand Forecasting with Discrete Choice Models
Wei Ke, Columbia University, 226 W 97th St, Apt 5D, New York, NY, 10025, United States of America, wke10@gsb.columbia.edu, Garrett van Ryzin

This project was conducted in conjunction with a local self-storage company. The objective was to design and implement a causal model that would forecast unit-level demand for a pilot facility. We found this a good opportunity to test the real-world effectiveness of demand forecasting with consumer choice models.

2 - Scope Insensitivity Across Time Perspectives: Affect as a Decision Making System of the Present
Hannah Chang, Assistant Professor of Marketing, Singapore Management University, 50 Stamford Rd. #05-01, Singapore, Singapore, hannahchang@smu.edu.sg, Michel Tuan Pham

We propose that the affective system is more likely to be engaged in decisions that are set in the present than in decisions that are set at distant times (past or future). As a consequence, people are more likely to exhibit a feature of this system in decisions—the scope insensitivity bias—for valuation decisions set in the present. Findings from four experiments are consistent with this proposition and show that this bias occurs in the present only when affective information is available.

3 - Competitive Pricing with Reference Effects
Srinivas Krishnamoorthy, Assistant Professor, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, skrishnamoorthy@ivey.ca

We examine the effect of reference prices on the pricing strategies of two competing firms. We show that, in a two period game, the effect of reference prices motivates firms to price higher at equilibrium then they would if there was no reference pricing effect. The analogy drawn within the paper is to the MP3-Player market, wherein incumbents have large reference price advantages over effectively equivalent new entrants.

■ SD32

H-Room 504, Fifth Level

Modeling Financial Markets in a Dynamic World

Cluster: Financial Engineering
Invited Session

Chair: John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

1 - Dynamic Asset Allocation for Hedging Downside Risk
Gerd Infanger, Research Professor, Stanford University, Department of Management Science and Eng, Palo Alto, CA, United States of America, infanger@stanford.edu

Conservative investors often wish to participate in the potentially higher returns of equities while trying to prevent capital loss. We show how dynamic asset allocation may balance long and short-term expected return-risk profiles. The approach is based on an application of approximate DP techniques. Numerical results detailing optimal global dynamic asset allocation strategies and evaluating the costs of hedging downside risk are presented.

2 - Investing in Turbulent Times: Applying Dynamic Portfolio Theory
John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

The nature of markets during turbulent periods is dramatically different than normal economic periods. We show that the U.S. equity returns can be modeled as a three regime Markov process — normal, bubble, and crash. Empirical results show the benefits of the three regime model from the standpoint of performance.

3 - What is the Shape of the Risk-Reward Relation?
Allan Timmermann, Professor, University of California, San Diego, San Diego, CA, United States of America, atimmermann@ucsd.edu

Using a flexible approach that avoids restrictive parametric assumptions, we find evidence of a non-monotonic relation between risk and expected returns: At low-to-medium levels of conditional volatility there is a positive trade-off between risk and expected returns, but this relationship gets inverted at high levels of conditional volatility. Our findings helps resolve why some empirical studies find a negative risk-return relation, while others find a positive trade-off.

4 - Capital Growth with Security with Convex Loss Penalties
William Ziemba, Professor, University of British Columbia, Canada, ziemba@interchange.ubc.ca

The Kelly capital growth criterion has many desirable properties especially in the long run. A related model is the dynamic fractional Kelly strategy that blends cash with the log-optimal so that the wealth path is above a specified growth path with high probability and violations below that path are convex penalties of shortfall. This model provides advantages, as describe in several practical examples.

■ SD33

H-Room 505, Fifth Floor

Strategic Interactions in Supply Chains with Uncertainty

Cluster: Economic Models in Operations Management
Invited Session

Chair: Yunzeng Wang, Dr., University of California Riverside, 900 University Avenue, Riverside, CA, United States of America, yunzeng.wang@ucr.edu

Co-Chair: Xiang Fang, University of Wisconsin-Milwaukee, Sheldon B. Lubar School of Business, P.O. Box 742, 3202 N. Maryland Ave, Milwaukee, WI, 53201-0742, fangx@uwm.edu

1 - Requirement or Promise? Quality-based Supplier Selection Strategies

Xinghao Yan, Assistant Professor, The University of Western Ontario, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, xyan@ivey.uwo.ca, Kwei Tang, Hui Zhao

We explore two different supplier selection strategies: quality requirement (QR) and quality promise (QR) in which the buyer and competing suppliers are the first mover, respectively. We analyze how QR and QP affect the players' quality improvement efforts, supply chain cost, and social welfare. We find first-mover right does not always benefit the buyer. Further, both QR and QP fully exploit the first-mover's cost effectiveness, but restrict the second-mover in different ways.

2 - Infinite Horizon Strategies for Replenishment Systems with a General Pool of Suppliers

Nan Yang, Assistant Professor, Cornell University, ny38@cornell.edu, Awi Federgruen

We characterize the structure of optimal infinite horizon strategies in replenishment systems, with an arbitrary pool of suppliers with distinct prices and yield characteristics, under the discounted cost criterion and the average cost criterion. We design exact solution methods as well as simple but accurate heuristics.

3 - Store Brand and Supply Chain Power Structure

Jun Ru, PhD Candidate, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, jun.ru@utdallas.edu, Jun Zhang

We examine the impacts of store brand products on supply chain members' performance under different supply chain power structures. Contrary to the well accepted notion that store brand hurts the national brand manufacturer, we find that the manufacturer can benefit from the introduction of a store brand product by the retailer. Moreover, retailer's power in the supply chain plays a significant role on the store brand quality.

4 - Modeling Production and Pricing Decisions of Durable Goods Manufacturer

Vera Tilson, Simon School of Businees, University of Rochester, Rochester, NY, 14627, United States of America, vera.tilson@Simon.Rochester.edu, Xiaobo Zheng

The effects of production lead time and uncertainty in demand for the product has not received much attention in modeling the decisions faced by a manufacturer of durable goods. We create a model to investigate production and pricing decisions for a durable goods manufacturer who is producing a product of finite durability in the presence of second-hand market, significant production lead times, and uncertainty in demand.

■ SD34

H-Room 520, Fifth Floor

Miscellaneous Topics in Green Supply Chains

Cluster: Green Supply Chain
Invited Session

Chair: Eylem Koca, R.H. Smith School of Business, University of Maryland, CP, VMH 3330, College Park, MD, 20742, United States of America, ekoca@rhsmith.umd.edu

1 - Retailing Customized Products: Pricing, Inventory and Refund Policies

Alex Grasas, Assistant Professor, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, Barcelona, 08005, Spain, alex.grasas@upf.edu, Elif Akcali, Aydin Alptekinoglu

We study optimal pricing, inventory, and refund policies of a customizing firm. We find that partial refunds are generally optimal. In a single-period setting, partial refunds allow the firm to charge a higher price than the price with no returns allowed. In a multiple-period setting, the firm passes some of the expected savings from being able to carry inventory from one period to another onto the customers, surprisingly, not in the form of higher refunds but of lower prices.

2 - Clean and Green: Balancing Economic and Environmental Interests in Equipment Maintenance Decisions

Thomas Sloan, University of Massachusetts Lowell, 1 University Ave, Department of Operations and Info. Sys., Lowell, MA, 01854, United States of America, Thomas_Sloan@uml.edu, Joseph Sarkis

The condition of a production system deteriorates over time, and this causes increased scrap, energy use, CO2 emissions, etc. More frequent maintenance (cleaning) reduces these impacts but increases economic costs. How can firms balance the economic and environmental concerns? We develop an MDP model to evaluate different objectives, using data from the Toxic Use Reduction Institute (TURI) to capture real-world environmental impacts.

3 - Return Policies and Informational Tools in Experience Good Markets

Eylem Koca, R.H. Smith School of Business, University of Maryland, CP, VMH 3330, College Park, MD, 20742, United States of America, ekoca@rhsmith.umd.edu, Gilvan Souza

We consider an experience good and analytically study the role of consumer return policies and informational tools in the market outcome by incorporating them in the seller's decision process along with pricing. Building a novel model of consumer learning over a two-period horizon, we show that return policies can be devised to effectively substitute for information, and that issuing no information can be optimal as well as allowing consumer dissatisfaction.

4 - Formative and Reflective Measurement Model for Competitive Capabilities in Operations Strategy

Choonho Ryu, Professor, Hongik University, 72-1 Sangsoo-dong Mapo-gu, Dep't of Business Administration, Seoul, 121-791, Korea, Republic of, ryuch@wow.hongik.ac.kr, Joungho Lee

High performance in one of the competitive capabilities of firms is posited to trade off for low performance in others. However, competitive progression theory posits that manufactures can achieve high performance in more than one capability simultaneously. This paper discusses the distinction between formative and reflective measurement models for the construct of competitive capabilities and provides empirical evidence for modeling reflective indicator construct of competitive capabilities.

■ SD35

H-Sapphire A, Fourth Floor

Treatment Management - Cancer

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - Novel Prognostic Ensemble Model for Robust Prediction of Survival in Breast Cancer Patients

Anupama Reddy, Graduate student, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, anupamar@gmail.com, Gyan Bhanot

We present a novel algorithm, "Ensemble Logical Analysis of Survival Datafor predicting survival of cancer patients based on patterns identified on gene expression data. This is a pattern-based method using the principles of LAD. We illustrate our method on a microarray dataset of 286 breast cancer samples. Our predictions are very well correlated with survival. We stratify the patients into risk groups and show that the survival distributions in the risk strata are significantly different.

2 - Evaluating Cervical Cancer Screening Strategies

Adriana Ley Chavez, The Ohio State University, ISE Department, Columbus, OH, United States of America, ley-chavez.1@osu.edu, Julia L. Higle

Oncogenic Human Papillomavirus (HPV) infections affect at least 25 per cent of US women over the course of their lifetime, and are a necessary cause for cervical cancer. Given that HPV is transmitted sexually, each patient's sexual behavior affects their probability of infection. In this presentation, we examine the effectiveness of alternative HPV screening strategies, including alternatives for screening based on consideration of risky behaviors.

■ SD36

H-Sapphire B, Fourth Floor

Recent Advances in OR Applications in Healthcare Decision Making

Sponsor: Health Applications
Sponsored Session

Chair: Gino Lim, University of Houston, Det. of Industrial Engr., E211 Engr. Bldg 2, Houston, TX, 77204, United States of America, ginolim@uh.edu

1 - A Local Search Method for Non-coplanar Beam Orientation Optimization in IMRT Treatment Planning

Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca, Velibor Misic, Michael Sharpe

We consider the beam orientation optimization (BOO) problem for total marrow irradiation (TMI) using intensity modulated radiation therapy (IMRT). IMRT is not widely used in TMI treatment delivery due to the difficulties in designing treatments. We propose two versions of a neighborhood search algorithm which solve the BOO problem effectively when non-coplanar beams are considered. The algorithms are performed in an acceptable amount of time and lead to high-quality treatments.

2 - Multi-Objective Nurse Scheduling Problem under the Consideration of Patient Demand and Nurse Shift Preferences

Arezou Mobasher, PhD Candidate, Department of Industrial Engr., W228, Eng Buld 2, Houston, TX, 77004, United States of America, amobasher@uh.edu, Gino Lim, Murray CÙté

The purpose of this paper is to develop a nurse scheduling model that simultaneously considers various aspects of goals such as minimizing cost, patient dissatisfaction, nurse idle time, and maximizing job satisfaction of nurses by incorporating preferences into optimization models. Both shift preferences for employee job satisfaction and patient demand for customer satisfaction are considered using a 2-stage non-weighted goal programming approach to find an efficient solution for this problem.

3 - Diabetes Quality Measurement Data Collection and Reporting in Primary Care Practice

Murray Côté, Associate Professor, University of Colorado Denver, Health Care Policy & Research, 136111 E. Colfax Avenue, Suite 100, Aurora, CO, 80045, United States of America, murray.cote@uchsc.edu, Tiffany Radcliff, David West, Perry Dickinson

Performance measurement data collection has become a very important issue for primary care practices. Performance data reporting initiatives have great potential for improving health care delivery and rewarding and reimbursing practices through pay for performance. Using process flow mapping, we identified the direct and indirect costs of implementing and maintaining diabetes quality measurement data collection and reporting in small to medium-sized primary care practices.

■ SD37

H-Sapphire C, Fourth Floor

Data and Model-Driven Supply Chain Research

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Hau Lee, Professor, Stanford University Graduate School of Business, 518 Memorial Way, Stanford, CA, 94022, United States of America, haulee@stanford.edu

1 - Inventories and Value of Postponement under Price Volatility

Vishal Gaur, Associate Professor, Johnson School, Cornell University, vg77@cornell.edu, Sridhar Seshadri, Marti Subrahmanyam

We present an analytical model of the optimal inventory decision of a firm when prices and demand are both volatile and their forecasts evolve over time. We test the implications of our model using data for public listed firms, and investigate how inventories observed in practice correlate with price volatility.

2 - Carbon Footprint and the Management of Supply Chains

Gerard Cachon, The Wharton School, University of Pennsylvania, 3730 Walnut St, #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, cachon@wharton.upenn.edu

Environmental management will clearly be a top priority over the coming decades. Future supply chains will probably want to reduce their carbon footprint. This talk will discuss how this new objective is likely to influence supply chain operations and structures.

3 - Drivers of Sales and Satisfaction in a Fast Food Restaurant

Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Marshall Fisher, Nicole DeHoratius

We describe research with a fast food restaurant chain that uses operating data, customer satisfaction survey results and in stock mystery shopping to identify drivers of sales and satisfaction. Particular attention is paid to the design of the restaurant process. This is part of a larger project with a number of retailers that aims to identify store operating policies that result in outstanding store execution, customer experience and financial performance.

4 - Rediscover the Bullwhip Effect: On the Measurement and Interpretation with Aggregate Data

Li Chen, Duke University, Fuqua School of Business, 1 Tower Drive, Durham, NC, 27708, li.chen@duke.edu, Hau Lee

Empirical studies have shown large magnitudes of the bullwhip effect at individual companies, but at a macro-level, that is not always the case. In this paper, we show how time aggregation could mask the magnitude of the bullwhip effect. We also study similar impacts when data is aggregated across products, and how the existence of order batching and seasonality could affect the measurement of the bullwhip effect.

■ SD38

H-Sapphire D, Fourth Floor

Forecasting for Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Ruud Teunter, University of Groningen, Zernike Complex Building H, Rroom 669, P.O. Box 800, 9700 AV Groningen, Netherlands, r.h.teunter@rug.nl

1 - Forecasting and Inventory Management in Multi-echelon Systems

Ton de Kok, Full Professor, Technology University of Eindhoven, Department of Technology Management, P.O.Box 513, Eindhoven, 5600MB, Netherlands, a.g.d.kok@tue.nl

In this presentation we discuss a non-stationary demand framework that can be used to model real-life demand processes and their associated forecasting processes. Based on these demand and forecast models we derive analytical expressions for the performance characteristics of multi-echelon inventory systems. We discuss the conditions under which these expressions are valid. Based on these expressions we propose an efficient heuristic to determine control parameters.

2 - Effect of Forecast Error on Inventory Performance

Nezih Altay, Associate Professor of Operations Management, DePaul University, 1 E. Jackson Blvd., College of Commerce, Chicago, IL, 60604, United States of America, naltay@richmond.edu, Ibrahim Kurtulus, Aris Syntetos

In this empirical study we show the effects of forecast error on the optimal inventory policy for spare parts with compound Poisson demand using real and simulated data.

3 - The Effects of Integrating Management Judgement into Statistical Demand Forecasts

Aris Syntetos, Reader (Associate Prrofessor), University of Salford, Salford Business School, Maxwell Building, Manchester, M5 4WT, United Kingdom, a.syntetos@salford.ac.uk, John Boylan, Konstantinos Nikolopoulos

A number of research projects have demonstrated that the efficiency of inventory systems does not relate directly to demand forecasting performance, as measured by standard forecasting accuracy measures. In this paper we address, empirically, the issue of judgementally adjusting statistical demand forecasts and the implications of such interventions both in terms of forecast accuracy and stock control, the latter being measured through inventory volumes and service levels achieved.

4 - A New Method for Forecasting Intermittent Demand

Ruud Teunter, University of Groningen, Zernike Complex Building H, Rroom 669, P.O. Box 800, 9700 AV Groningen, Netherlands, r.h.teunter@rug.nl, Aris Syntetos, Mohamed Zied Babai

The Croston method updates demand size and demand interval in periods with positive demand, and uses their ratio as the forecast. So, periods with zero demand do not imply that forecasts are adjusted downwards. Therefore, demand information is not fully utilised and estimates of inventory obsolescence risk are biased. Our new method avoids these drawbacks by updating the demand interval in every period. Numerical studies on real-life datasets show that our method improves forecasting accuracy.

■ SD39

H-Sapphire E, Fourth Floor

Customer-oriented Operations Models

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Fuqiang Zhang, Assistant Professor, Washington University in St. Louis, FZhang22@wustl.edu

1 - Leveraging 'Buzz' Created by Product Stock-outs
Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu, Garrett van Ryzin

We study how stock-outs influence consumer purchasing behavior for new or innovative products with unknown quality. Stock-outs can contain information about the propensity of other consumers to purchase the product and hence increase the willingness of marginally interested consumers to buy product. We discuss how a firm can leverage this phenomenon.

2 - Pricing and Quantity Decisions under Conspicuous Consumption
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Necati Tereyaoglu

We model the value of stockouts for products which are consumed or purchased conspicuously. We examine the influence of scarcity on the valuation of the customer for the product, leading to its effects on the demand, and pricing and production decisions of a monopolist. We find to signal scarcity, the producer may spend higher production cost on the product.

3 - Service Capacity Management with Strategic Customers
Haiyan Wang, Washington University in St. Louis, 38597 Vancouver CMN, Fremont, CA, 94536, United States of America, hwang27@wustl.edu, Tava Olsen

We consider a service provider managing capacity in the presence of demand surges. Under this strategy, some customers who arrive in the peak demand period are offered a discount if they are willing to be postponed to a non-peak period. However, some non-peak period customers are strategic and may pretend to be a peak period customer in order to obtain a discount. We analyze the effect of the strategic customers' behavior on the service provider's capacity decisions and postponement strategy.

4 - Advance Demand Information, Price Discrimination, and Pre-order Strategies
Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu, Fuqiang Zhang

Pre-order refers to the practice of a seller accepting customer orders before the product is released. From the seller's perspective, a pre-order strategy provides values of price discrimination and advance demand information. We analyze how these two values interact with each other under different environments.

■ SD40

H-Sapphire H, Fourth Floor

Computational Methods in Financial Engineering

Sponsor: Financial Services
Sponsored Session

Chair: Zhen Liu, Assistant Professor/Senior Visiting Scholar, Missouri S&T/Tsinghua University, 216 Engineering Management, 600 W. 14th St., Rolla, MO, 65409-0370, United States of America, zliu@mst.edu

1 - Pricing Asian Options under a Flexible Jump Diffusion Model
Ning Cai, Assistant Professor, Department of IELM, HKUST, Hong Kong, China, ningcai@ust.hk, Steven Kou

We derive a closed-form double-Laplace transform of the Asian option price under the hyper-exponential jump diffusion model (HEM) by studying the distribution of a related integral of the underlying asset price process. Compared with the existing methods to study the distribution of this kind of integral that apply only for the Black-Scholes model (BSM), our approach is much simpler and more robust in that it relies solely on Ito's formula and applies for both the BSM and the HEM.

2 - A Non-zero Game Approach to Convertible Bonds: Pricing, Optimal Strategy and Late Call
Nan Chen, Assistant Professor, Chinese University of Hong Kong, 709A, William Mong Engineering Building, Chinese University of Hong Kong, Shatin, Hong Kong - PRC, nchen@se.cuhk.edu.hk, Xiangwei Wan

Convertible bond is a hybrid security which embodies both characteristics of regular bond and equity. This mixed feature complicates the analysis of convertible bonds, especially in the presence of credit risk and corporate tax. In this paper, we are going to investigate the optimal strategies for both bondholders and shareholders using a non-zero game-theoretic approach. The obtained optimal call strategy enables us to provide a possible explanation to the empirical puzzle of "late call".

3 - Invert Characteristic Functions and Monte Carlo Simulation
Liming Feng, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@uiuc.edu

We present an efficient method for the inversion of a characteristic function. Multiple values of the cdf of a distribution with analytic characteristic function can be computed accurately and efficiently. Applications of the method to monte carlo simulation will be shown.

4 - Energy Portfolio Management with Entry Decisions
Zhen Liu, Assistant Professor/Senior Visiting Scholar, Missouri S&T/Tsinghua University, 216 Engineering Management, 600 W. 14th St., Rolla, MO, 65409-0370, United States of America, zliu@mst.edu

Due to the fluctuations of energy prices energy companies will employ alternative power generating technologies to form an energy portfolio to diversify risks. We study the optimal time to build the alternative plant, and the optimal dispatch from the existing plant and the new plant. We decompose this problem into an optimal stopping and a stochastic control problem. Numerical results are presented to characterize the optimal policy.

■ SD41

H-Sapphire L, Fourth Floor

JFIG Paper Competition I

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Ananth Iyer, Purdue University, aiyer@purdue.edu

1 - On Mixing Sets Arising in Chance-constrained Programs
Simge Kucukyavuz, Ohio State University, Columbus, OH, 43202, United States of America, kucukyavuz.2@osu.edu

We consider the intersection of multiple mixing sets with common binary variables arising in the deterministic equivalent of mathematical programs with chance constraints. We propose a blending procedure that gives strong valid inequalities for the intersection of mixing sets. We also give the relationship between the blending coefficients and the p-efficient points defined for chance-constrained programs.

2 - Design Outsourcing in a Differentiated Product Market: The Role of Bargaining and Scope Economies
Annabelle Feng, Assistant Professor, University of Texas-Austin, McCombs School of Business, 1 Univresity Station B6500, Austin, TX, 78712-0201, United States of America, annabelle.feng@mccombs.utexas.edu, Lauren Xiaoyuan Lu

During the last two decades, original equipment manufacturers (OEMs) gradually extended their outsourcing activities beyond manufacturing and outsourced product design and development to original design manufactures (ODMs). This new outsourcing model shifts the control of product design from an OEM to an ODM. We develop a dynamic game to study how design outsourcing may impact product differentiation and downstream competition among OEMs.

3 - Personalized Dynamic Pricing of Limited Inventories
Goker Aydin, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, ayding@umich.edu, Serhan Ziya

We consider the possibility of charging prices that are adjusted according to customer-specific information (a customer signal) as well as time and inventory. Such customization is effective as long as the seller can identify the customer as belonging to a certain market segment, an identification that is not always perfect. We find conditions under which a signal is a meaningful input to pricing decisions. We investigate how the benefits from price customization depend on inventory and time.

4 - Pricing with Markups in Industries with Increasing Marginal Costs
Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu, Jose Correa, Nicholas Figuerosa

We study a game in which producers adopt price functions proportional to their production costs by deciding which markups to charge. In a second phase, consumers learn the producers' price functions, which leads to an allocation of consumers to producers. We look at characteristics of the resulting equilibrium and show that its social cost is close to that of the optimal allocation. In particular, we study the worst-case inefficiency as a function of the competitiveness of the marketplace.

■ SD42

H-Sapphire P, Fourth Floor

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu

1 - Approximation Algorithms for the Stochastic Lot-sizing Problem
Cong Shi, PhD Candidate, Massachusetts Institute of Technology, Apt 396C, 70 Pacific St, Cambridge, MA, 02139, United States of America, shicong@MIT.EDU, Retsef Levi

We develop new algorithmic approaches to compute provably near-optimal policies for multiperiod stochastic lot-sizing inventory models with stochastic, non-stationary and correlated demands that evolve over time. This is one of the core models in inventory theory that has challenged researchers and practitioners for several decades. The policies that we develop have worst-case performance guarantees and perform very close to optimal in computational experiments.

2 - Fluid Models of Many-server Queues with Abandonment
Jiheng Zhang, Georgia Institute of Technology, Atlanta, GA, jrz@gatech.edu

We study many-server queues with abandonment in which customers have general service and patience time distributions. The dynamics of the system are modeled using measure-valued processes, to keep track of the residual service and patience times of each customer. Deterministic fluid models are established to provide first-order approximation for this model. The fluid model solution, which is proved to uniquely exists, serves as the fluid limit of the many-server queue, as the number of servers becomes large. Based on the fluid model solution, first-order approximations for various performance quantities are proposed

3 - Random Decision Networks: Correlation Decay and Decentralized Optimization
Théophane Weber, MIT, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, United States of America, theo_w@mit.edu, David Gamarnik

We consider a decision network in which each node corresponds to a decision variable, and each node and edge of the graph is associated with a reward function whose value depends only on the variables of the corresponding nodes. This model encompasses a variety of models, including maximum likelihood inference in graphical models or Markov random fields, and combinatorial optimization in graphs. The network is endowed with a probabilistic structure in which local costs are sampled from a distribution. Our aim is to identify sufficient conditions on the network structure and costs distribution to guarantee average-case polynomiality of the optimization problem; we also wish to characterize the efficiency of a decentralized solution generated on the basis of local information. We construct a new decentralized algorithm called Cavity Expansion and establish its theoretical performance for a variety of graph models and reward function distributions.

4 - Orbital Branching
James Ostrowski, University of Waterloo, jostrows@engmail.uwaterloo.ca, Stefano Smriglio, Fabrizio Rossi, Jeff Linderoth

We introduce orbital branching, an effective branching method for integer programs containing a great deal of symmetry. The method computes equivalent variables wrt the symmetry remaining in the problem. These groups of equivalent variables (orbits) are used to create a partitioning of the feasible region which reduces the effects of symmetry while still allowing a flexible branching rule. We also show how to exploit the symmetries present to fix variables throughout the tree.

5 - Fluid Model of the Resilient Packet Ring
Jian-Qiang Hu, Professor, Fudan University, Siyuan Building, Rm 508, 670 Guoshun Rd, Shanghai, 200433, China, hujq@fudan.edu.cn, Min Chen

In this paper, we develop a fluid model for the study of Resilient Packet Ring (RPR). The key characteristic of our proposed fluid model is that it has multiple classes of flows that are processed based on dynamic priority service disciplines. We derive the differential dynamic equations for the fluid model and demonstrate how the technique of perturbation analysis can be used in such a fluid model to perform sensitivity analysis with respect to key parameters of interest.

■ SD43

H-Room 400, Fourth Floor

Carbon Emissions and the Supply Chain

Cluster: Supply Chain Models
Invited Session

Chair: Saif Benjaafa, Professor, University of Minnesota, Industrial and Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu

1 - Estimating Carbon Emissions From Transportation: The Shipper's Perspective
Edgar Blanco, Executive Director, MIT Center for Latin-American Logistics Innovation, MIT, 77 Massachusetts Ave, E40-295, Cambridge, MA, 02139, United States of America, eblanco@MIT.EDU, Anthony Craig, Yossi Sheffi

In the absence of direct monitoring of CO2 emissions a number of methods exist to estimate emissions based on fuel consumption. However, much of the information required to estimate fuel consumption is carrier dependent and unknown to the shipper ahead of time. In this research we compare the shipper's estimated emissions using several methods and assumptions regarding carrier performance.

2 - Carbon Emissions in Distribution Networks
Jan Fransoo, Professor, Eindhoven University of Technology, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, J.C.Fransoo@tue.nl, Tarkan Tan

We report on an empirical study to measure carbon emissions in European distribution networks, based on field work with four companies. We present the various available standards with their limitations, and also demonstrate the potential reductions in carbon emissions that can be obtained. We show cases where lower emissions result in lower cost and vice versa, and briefly discuss the consequences of new legislation.

3 - Addressing Carbon Emissions via Supply Chain Planning and Coordination: Insights From Simple Models
Saif Benjaafar, Professor, University of Minnesota, Industrial and Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu, Yanzhi Li

We present models to support the design, planning, and coordination of supply chains with carbon emissions in mind. We show how operational decisions and supply chain coordination can have a dramatic impact on carbon emissions. We describe policy implications for how carbon emission targets should be set and how incentives for sharing the carbon emission burden across the supply chain be designed.

■ SD44

H-Room 402, Fourth Floor

Stochastic Analysis in Workforce Management

Sponsor: Service Science
Sponsored Session

Chair: Mark Squillante, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134/P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, mss@watson.ibm.com

Co-Chair: Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heighs, United States of America, yingdong@us.ibm.com

1 - Dynamic Worker Allocation in Capacity-constrained Systems
Salih Tekin, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, stekin@gatech.edu, Douglas Down, Sigrun Andradottir

Consider a stochastic system where workers are cross-trained and demand exceeds the capacity for service. We determine how the workers should be assigned to tasks to achieve a desired throughput for a given demand, provided that the throughput is feasible. This is accomplished using the solutions of linear programming problems, and the throughput guarantees are demonstrated using fluid model techniques. Several numerical examples will be discussed to illustrate key concepts.

2 - Optimal Call Center Staffing with Arrival Uncertainty II
Achal Bassamboo, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, 60208, a-bassamboo@kellogg.northwestern.edu, Assaf Zeevi, Ramandeep Randhawa

We study the capacity sizing problem in a call center faced with an uncertain arrival rate. In a large system setting, we first characterize the solution to the first order fluid problem. We show that the fluid prescription can have an Order-1 optimality property. That is, its optimality gap does not increase with system size.

3 - Service Level Variability of Inbound Call Centers
Alex Roubos, VU University Amsterdam, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, aroubos@few.vu.nl, Raik Stolletz, Ger Koole

The Erlang C formula and its generalizations have often been used to find the number of agents that satisfy some service level (SL) criterion. These formulas assume that the system has reached stationarity; this is not true in reality where SLs are aggregated over intervals no longer than 24 hrs. In such small intervals the SL is a random variable. We propose a simple formula for the standard deviation of the SL and use this together with a normal approximation to show highly accurate results.

4 - Stochastic Workforce Optimization via a General Stochastic Loss Network
Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heights, United States of America, yingdong@us.ibm.com, Ana Radovanovic, Mark Squillante

Modeling workforce dynamics as a loss network under general arrivals, we derive an asymptotically exact Gaussian fixed-point approximation for the network loss probabilities. We then formulate and solve single-period, multi-period and dynamic stochastic capacity planning optimization/control problems based on our FPA, whose solutions are also shown to be asymptotically exact. Numerical studies illustrate approximation accuracy and solution dependencies on demand variability and cost structure.

■ SD45

H-Room 410, Fouth Floor

Research, Development, Architecture and Complexity

Cluster: New Product Development
Invited Session

Chair: Jurgen Mihm, Assistant Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu

1 - Complexity and Efficiency of Globally Distributed Vehicle Design
Bilal Gokpinar, Lecturer, University College London, United Kingdom, b.gokpinar@ucl.ac.uk, Seyed Iravani, Wallace Hopp

We study the vehicle development process of a large auto manufacturer, whose design teams span the globe. Using networks to characterize both the product architecture and design team coordination, we investigate the impact geographic separation of design teams has on the operational efficiency and product quality of the system. Our results suggest that splitting subsystem design across geographic boundaries can have a deleterious effect on performance.

2 - How Long Does it Take to Fix a Bug? Architecture and Bug Fixing Time in Open Source Software
Manuel Sosa, Associate Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu, Jurgen Mihm, Tyson Browning

We examine a large longitudinal sample of bugs associated with several open source applications developed by Apache. We study the link between software architectural properties and time to fix bugs. Our results suggest that some architectural properties of software applications are important determinants of bug fixing time.

3 - Strategy Deployment: Decentralized Decision Making and Innovation
Fabian Sting, INSEAD, Boulevard de Constance, Fontainebleau, France, fabian.sting@insead.edu, Christoph Loch, Jurgen Mihm

Strategy making and deployment are neither top-down nor bottom-up. In organizational search different kinds of decisions are made at different levels in the organization, and coordination happens through multiple methods. Innovation happens in a combination of target fulfillment and offering new solutions and combines products, processes and structures. We show a modeling representation of strategy deployment, and present multiple case study results.

■ SD46

H-Room 411, Fourth Floor

NPD and Knowledge Management

Sponsor: Technology Management
Sponsored Session

Chair: Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 117B Sirrine Hall, Clemson, SC, 29631, United States of America, gulruo@clemson.edu

1 - Product Platform Strategies Implications for Supply Chain Integration
Juliana Hsuan, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK, 2000, Denmark, jh.om@cbs.dk

A conceptual framework called Platform Product Matrix (PPM) is introduced to assess product platform strategies (i.e. product architecture modularity) with respect to supply chain integration (i.e. the application of inter-organizational systems, supplier involvement, and product customization). PPM provides insights into how product variants would influence supply chain design and resource allocation.

2 - Fusion Diffusion Confusion
Yuwen Chen, Assistant Professor of Supply Chain Management, University of Rhode Island, 7 Lippitt Road, Kingston, RI, 02881, United States of America, yuwen@mail.uri.edu, Janice Carrillo

As multifunction products (also referred to as fusion products) gain popularity, we observe that single-function products gradually disappear from the market as they are supplanted by fusion products. This paper presents a product diffusion model that captures the transition from two distinct single-function products into one fusion product. We investigate the optimal launch time of the fusion product and conduct a numerical analysis to demonstrate the dynamics among the three products.

3 - Managing New Product Development Knowledge between Competing Firms
Gulru Ozkan, Clemson University, United States of America, Gulruo@exchange.clemson.edu, Cheryl Gaimon

We introduce a two period stochastic game on KM for NPD of two competing firms. First, leader sets price for knowledge transfer (patents); follower decides how much knowledge to acquire. Next, firms pursue knowledge development (problem solving). Finally, both firms release new products. Insights include impact of uncertain market forces.

4 - Workforce Knowledge Management and the Implementation of New Technology
Cheryl Gaimon, Professor, Georgia Institute of Technology, 800 W. Peachtree St. NW, Atlanta, GA, 30308-0520, United States of America, Cheryl.Gaimon@mgt.gatech.edu, Karen Napoleon, Gulru Ozkan

We consider a firm's dynamic resource capabilities and demonstrate importance of managing workforce knowledge for a technology upgrade. We examine how workforce knowledge changes over time due to upgrade and independent from it. We capture knowledge depreciation, learning-before-doing, forgetting; showing dramatically different KM strategies are needed before/after an upgrade.

■ SD47

H-Room 412, Fourth Floor

Doing Good with Good OR Student Competition I

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu

Co-Chair: Cynthia Barnhart, Associate Dean for Academic Affairs, MIT, School of Engineering, Cambridge, MA, 02139, United States of America, cbarnhart@MIT.EDU

1 - Doing Good with Good OR Student Competition
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu, Cynthia Barnhart

"Doing Good with Good OR Student Competition" is a new INFORMS sponsored competition to encouraging student research and practice with societal impact. This competition is intended to recognize student-led projects with real-world

clients that generate significant societal impacts beyond increased profits or reduced costs. The finalists session will feature the most exciting work performed by students in partnership with public and private organizations that results in tangible, beneficial outcomes for individuals, communities and organizations. The winner of the competition will be decided after the presentations and announced at the awards ceremony on Sunday night.

2 - Network Design for Middle East Water Distribution

Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu, Rachel Bullene, Ed Boone

This project involves building a model to aid decision-makers in designing an optimal water distribution network in the Middle East. Our model incorporates a Bayesian simulation wrapped around a deterministic optimization model to represent uncertainty. The output of the model is a most-probable least-cost network design and network component probabilities.

3 - Catch-up Scheduling for Childhood Immunization

Faramroze Engineer, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, fenginee@isye.gatech.edu, Larry K. Pickering, Pinar Keskinocak

We outline the development of an optimization based decision support tool to help providers and caretakers in constructing catch-up schedules for childhood immunization. These schedules ensure that a child continues to receive timely coverage against vaccine preventable diseases in the likely event that one or more doses have been delayed. The tool is advocated by both the CDC and AAP as a means of encouraging caretakers and providers to take a more proactive role in ensuring timely coverage.

4 - Optimal Learning for Drug Design in Ewing's Sarcoma

Diana Negoescu, Stanford University, Management Science and Engineering Department, Palo Alto, CA, United States of America, negoescu@princeton.edu, Peter Frazier, Warren Powell

Developing a new drug involves a time-consuming sequence of experiments in which new molecules are synthesized and tested, and the results used to choose which molecule to test next. Choosing molecules to test in a wise way reduces the number of experiments that must be performed, and makes drug development efforts more likely to succeed. In collaboration with a pediatric oncology group at Georgetown University, we develop a new Bayesian decision-theoretic method for making these choices.

■ SD48

H-Sapphire Green Room, Fourth

Organization Science: The Journal and the State of the Art

Sponsor: Organizational Science
Sponsored Session

Chair: Kyle Lewis, Associate Professor, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, kyle.lewis@mccombs.utexas.edu

1 - Intra-organizational Networks, Inter-organizational Networks and the Impact of Central Inventors

Srikanth Paruchuri, University of Florida, Warrington College of Business Administr, P.O. Box 117165, Gainesville, FL, 32611, United States of America, paruchur@ufl.edu

This paper proposes that a mechanism through which a firm's location in the inter-organizational network influences the firm's internal innovation activities is by modifying the amount of information flowing within the firm. Consequently, I hypothesized that the relationship between an inventor's centrality and his impact on a firm's innovation activities is moderated by the firm's centrality and span of structural holes in the inter-firm network.

2 - External Learning Activities and Team Performance: A Multimethod Field Study

Henrik Bresman, INSEAD, 77305 Fontainebleu, Cedex, France, henrik.bresman@insead.edu

This paper reports on a study of external team learning activities and their performance effects. Qualitative data from six teams in one pharmaceutical firm are used to develop measures. Survey data from 62 additional teams in six other pharmaceutical firms are used to test the proposed model. The paper contributes by distinguishing between different kinds of external learning activities and showing that they put different demands on teams to be effective.

3 - Securities Analysts and Incumbent Response to Radical Technological Change

Mary Benner, Management Department, The Wharton School, Philadelphia, PA, 19104, United States of America, benner@wharton.upenn.edu

Research has studied the factors that impede firms' responses to radical technological change, but little work in the technological change literature considers the role of equity markets or securities analysts in incumbent firms' responses to technological change. This paper empirically explores how analysts react to different strategies undertaken by incumbent firms faced with radical technological change, and illuminates the nature and direction of possible pressures from analysts.

4 - The Next Generation: Technology Adoption and Integration through Internal Competition

Alva Taylor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States of America, alva.taylor@dartmouth.edu

This paper examines the impact of internal competition that occurs when new technology challenges a firm's existing products. Evidence from a field study on new-technology product development shows that internal competition influences existing-technology product development groups to integrate the new technology into the next generation of their products. These existing groups shift their search toward the new technology, and gain access to information through internal worker mobility.

■ SD49

H-Room 300, Third Floor

Panel Discussion: Teaching Modern Project Management

Cluster: Project Management
Invited Session

Chair: Nicholas Hall, Professor, The Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu

1 - Teaching Modern Project Management

Moderator: Nicholas Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall.33@osu.edu, Panelists: Brian Tomlin, Vijay Mehrotra

Panel members will share their project management teaching experiences regarding: benefits and challenges of teaching this course, instructor workload, marketing the course to potential students, prerequisite courses, overall course design, technical level of the course, managing students' expectations, cases, student presentations, games and simulation exercises, software support, guest speakers, final exams, integration with other courses, and teaching the course in an online environment.

■ SD50

H-Room 302, Third Floor

Online Resources for Teaching a POM Course with Balanced Service and Supply Chain Content

Cluster: Service Operations Management
Invited Session

Chair: Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

1 - Online Resources for Teaching a POM Course with Balanced Service and Supply Chain Content

Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu, Ken Boyer

Increasing core POM courses are designed to provide a balanced overview of manufacturing and service operations along with supply chain management concepts. Furthermore, there seems to be a greater need to incorporate online learning resources for various instructional needs (e.g. assignments, multi-media cases, etc). This workshop will review some of the new resources available for instructors of core POM classes.

■ SD51

H-Room 303, Third Floor

Matrix Rank Minimization: Theory and Algorithms

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Maryam Fazel, Assistant Professor, University of Washington, Campus Box 352500, Univ of Washington, Seattle, WA, 98195, United States of America, mfazel@u.washington.edu

1 - Matrix Completion From A Few Entries

Andrea Montanari, Professor, Standord University, Packard Bldg, Stanford, CA, 94025, United States of America, montanar@stanford.edu, Raghunandan Keshavan, Sewoong Oh

We consider the use of low-rank models in collaborative filtering (the `Netflix problem'). Given M, a n x n `incoherent' matrix of rank r, a random subset of its entries is observed. We describe an efficient algorithm that reconstructs M from O(rn) entries with arbitrarily small RMSE. If r = O(1), it reconstructs M exactly from O(n log n) entries. The algorithm is robust with respect to noise. In the case of gaussian noise, it appears to surpass approaches based on nuclear norm relaxation.

2 - Exact Matrix Completion via Convex Optimization

Emmanuel Candes, CalTech, emmanuel@acm.caltech.edu, Terence Tao

We observe a few entries from a matrix and ask whether we can complete the matrix and recover the entries we have not seen. This is the famous Netflix problem. We show that surprisingly one can recover low-rank matrices exactly from what appear to be highly incomplete sets of entries. Further, perfect recovery is possible by solving a semidefinite program. Our methods are optimal and succeed as soon as recovery is possible by any method whatsoever.

3 - Fixed Point and Bregman Iterative Methods for Matrix Rank Minimization

Shiqian Ma, Columbia University, 500 W. 120TH ST, Mudd Building, RM 313, New York, NY, 10027, United States of America, sm2756@columbia.edu, Donald Goldfarb

We consider in this talk the linearly constrained matrix rank minimization problem. We propose fixed point and Bregman iterative algorithms for solving the nuclear norm minimization problem, which is the tightest convex relaxation of this problem. Our algorithm can recover 1000 by 1000 matrices of rank 50 with a relative error of 1e-5 in about 3 minutes sampling only 20 percent of the elements. We know of no other method that achieves as good recoverability.

4 - Results on Low-rank Matrix Recovery From Noisy Data

Maryam Fazel, Assistant Professor, University of Washington, Campus Box 352500, Univ of Washington, Seattle, WA, 98195, United States of America, mfazel@u.washington.edu

We consider the problem of recovering a low-rank matrix from various classes of limited and noisy observations. We show that minimizing the nuclear norm of the matrix (i.e., the sum of its singular values) subject to the observations provides not only a provably good approximation of the unknown matrix, but also a way to estimate the correct rank and the singular spaces of the matrix.

■ SD52

H-Room 304, Third Floor

Marketing and Operations Decisions

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Kathryn Stecke, Ashbel Smith Professor, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, kstecke@utdallas.edu

1 - Pricing and Lead-time Decisions in a Duopoly Common Retailer Channel

Zhengping Wu, Singapore Management University, Lee Kiong Chain School of Business, Singapore, Singapore, zpwu@smu.edu.sg, Xiuming Niu, Scott Webster, Kum-Khiong Yang

We study a two-tier decentralized supply chain consisting of two suppliers and two common retailers facing a price- and lead-time-sensitive demand. We construct three different games to analyze the optimal price and lead-time decisions. We show the existence of a unique equilibrium in all games and discuss managerial implications of our modeling results.

2 - Requiring Minimum Sale Volumes to Trigger an Increase in Commissions under Competition

Guillermo Gallego, IEOR Department, Columbia University, 313, 500W, 120 St, New York, NY, 10027, United States of America, ggallego@ieor.columbia.edu, Masoud Talebian

We consider a game between two providers and a broker and study the effects of requiring minimum sale volumes to trigger commissions. With fixed commission margins, at least one provider has an incentive to impose thresholds at the expense of the broker. If the providers also compete with commission margins then in equilibrium the smaller provider loses and the broker benefits. Thresholds with variable margins is the only stable equilibrium but it is not Pareto optimal.

3 - Impact of Shared Capacity on Socially Efficient Product Lines

Jay Swaminathan, Kay and Van Weatherspoon Distinguished Professor of Operations, Technology and Innovation Management, Kenan-Flagler Business School, Campus Box 3490, McColl Building, Chapel Hill, NC, 27599, United States of America, msj@unc.edu, Muge Yayla-Kullu, Ali Parlakturk

We consider a social planner offering two products that differ in their quality and vary in their unit costs and capacity consumption. In particular, we study socially efficient product line choice, capacity allocation and pricing decisions. In contrast to the existing literature, we show that capacity constraint may induce a social planner to provide a quality level that is worse than a monopolist.

4 - Dynamic Pricing and Customer Relationships: Selling to Learn or Learning to Sell?

Rene Caldentey, Associate professor, New York University, rcaldent@stern.nyu.edu, Paulo Rocha e Oliveira, Gabriel Bitran

Knowing each customer's preferences enhances a firm's ability to design and offer the right selection and configuration of products and services. We use an axiomatic approach to develop a learning model that enables us to quantify the trade-off between the value and the cost of knowing the customers. This learning model is used to investigate how pricing policies can be used to speed up the learning process while maximizing the firm's financial performance.

■ SD53

H-Room 305, Third Floor

MIP Methodologies for Non-Convex Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Anureet Saxena, Research Associate, Axioma Inc, 2313 Charleston Place, Atlanta, GA, 30338, United States of America, asaxena@axiomainc.com

1 - Projected Formulations for Non-Convex Quadratically Constrained Programs

Anureet Saxena, Research Associate, Axioma Inc, 2313 Charleston Place, Atlanta, GA, 30338, United States of America, asaxena@axiomainc.com, Jon Lee, Pierre Bonami

A common way to produce a convex relaxation of a MIQCP is to lift the problem into a higher dimensional space by introducing additional variables to represent bilinear terms, and strengthening the resulting formulation using SDP constraint and disjunctive programming. In this paper, we study projection methods to build low-dimensional relaxations of MIQCP that capture the strength of these extended formulations.

2 - Global Optimization of MINLPs with BARON

Nick Sahinidis, John E. Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, United States of America, sahinidis@cmu.edu, Mohit Tawarmalani

We present extensive computational experience with a new version of BARON for the solution of MINLPs that possess convex or nonconvex relaxations when integrality requirements are relaxed. The approach incorporates MIP relaxations judiciously, in conjunction with cutting plane generation and range reduction, to significantly reduce computational requirements and expedite solution.

3 - Tighter Relaxations for Global Optimization Problem with Multilinear Terms

Jeff Linderoth, University of Wisconsin, 1513 University Ave, 3226 Mechanical Engineering Building, Madison, WI, United States of America, linderot@cae.wisc.edu, Jim Luedtke, Mahdi Namazifar, Andrew Miller

Multilinear functions appear in many global optimization problem. A common technique for creating relaxations of such terms is to decompose them into bilinear terms and then use a relaxation (the McCormick envelope) for each term separately. We study an approach that generates a relaxation directly from the multilinear term and show that in some cases this can lead to a tighter relaxation. Computational results will be presented.

■ SD54

H-Room 306A, Third Floor

Online Learning

Sponsor: Optimization/Networks
Sponsored Session

Chair: Satyen Kale, Postdoctoral Researcher, Microsoft Research, 1 Memorial Drive, Cambridge, MA, 02138, United States of America, satyen.kale@gmail.com

1 - Stochastic Linear Optimization under Bandit Feedback
Varsha Dani, University of New Mexico, Department of Computer Science, Albuquerque, United States of America, varshadani@gmail.com, Thomas Hayes, Sham Kakade

In the classical stochastic k-armed bandit problem, in a sequence of trials, a decision maker chooses one of k arms and incurs a cost chosen from an unknown distribution associated with that arm. The goal is to minimize "regretthe difference between the cost incurred by the algorithm and the optimal cost. We study an extension where the k arms correspond to vectors in R^n, and the cost functions are linear. We describe an algorithm that works well even for infinite decision sets.

2 - Online Learning for Sponsored Keyword Search with Budgets
Thomas Hayes, University of New Mexico, Department of Computer Science, Mail stop: MSC01 1130, Albuquerque, NM, 87108, United States of America, hayes@cs.unm.edu, Nikhil Devanur

We consider the problem of a search engine trying to assign a sequence of search keywords to a set of competing bidders, each with a daily spending limit. The goal is to maximize the revenue generated by these keyword sales, bearing in mind that, as some bidders may eventually exceed their budget, not all keywords should be sold to the highest bidder. We assume that the sequence of keywords (or equivalently, of bids) is revealed on-line.

3 - Strong Convexity and Strong Smoothness: Applications to Learning with Matrices
Ambuj Tewari, Research Assistant Professor, Toyota Technological Institute at Chicago, 6045 S Kenwood Ave, Chicago, IL, 60615, United States of America, tewari@tti-c.org, Sham Kakade, Shai Shalev-Shwartz

A number of online learning algorithms rely on strong convexity. Well-known examples are weighted majority and online gradient descent. The property of strong smoothness is dual to strong convexity. We point out some interesting consequences of this duality and also show how to construct strongly convex functions over matrices based on strongly convex functions over vectors. The newly constructed functions inherit the strong convexity properties of the underlying vector functions.

4 - Learning, Optimization and Bandits
Jacob Abernethy, PhD Student, University of California at Berkeley, 387 Soda Hall, Berkeley, CA, 94720, jake@cs.berkeley.edu

The problem of optimizing a sequence of functions in an online fashion, known as Online Convex Optimization (OCO) has gained considerable interest in recent years. The setting provides a generic framework for a host of problems including learning with expert advice, linear pattern recognition, and portfolio selection. In this talk, I will present a new technique for OCO and show how it leads to a new analysis for the "bandit setting". This is joint work with Alexander Rakhlin from UPenn.

■ SD55

H-Room 306B, Third Floor

Algorithmic Mechanism Design

Sponsor: Optimization/Networks
Sponsored Session

Chair: Moshe Babaioff, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, moshe@microsoft.com

1 - Economics and Differential Privacy
Mukund Sundararajan, Stanford University, 353 Serra Mall, Stanford, United States of America, mukous@gmail.com

Differential Privacy is a privacy framework that consists of a rigorous definition of privacy, along with mechanisms for diverse applications. We discuss: A. An economically motivated definition of utility, and identify optimal privacy mechanisms, i.e. mechanisms that optimize utility subject to privacy constraints. B. We discuss why privacy is a preference, and suggest a generalization of differential privacy as a meaningful definition.

2 - Complexity of Combinatorial Auctions: Putting the VC in VCG
Yaron Singer, UC Berkeley, 615 Soda hall, Berkeley, CA, 94709, United States of America, yaron@cs.berkeley.edu, Elchanan Mossel, Christos Papadimitriou, Michael Schapira

The existence of truthful, computationally-efficient protocols for combinatorial auctions with decent approximation ratios is a central and well studied open question in mechanism design. The only general technique known for the design of truthful mechanisms is the VCG scheme. We present a first-of-its-kind technique for proving computational-complexity inapproximability results for VCG mechanisms for combinatorial auctions via a generalization of the VC-dimension to k-tuples of disjoint sets.

3 - Characterizing Truthful Multi-Armed Bandit Mechanisms
Moshe Babaioff, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, moshe@microsoft.com, Yogeshwar Sharma, Aleksandrs Slivkins

We investigate how the design of multi-armed bandit algorithms is affected by the restriction that the resulting mechanism must be truthful. We find that truthful mechanisms have certain strong structural properties — essentially, they must separate exploration from exploitation — and they incur much higher regret than the optimal multi-armed bandit algorithms. Moreover, we provide a truthful mechanism which matches our lower bound on regret.

■ SD56

H-Room 307, Third Floor

Optimization Methods for Data Classification

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Hong Seo Ryoo, Associate Professor, Korea University, 1, 5-Ka, Anam-Dong, Seongbuk-Ku, Seoul, Korea, Republic of, hsryoo@korea.ac.kr

1 - Efficient Piecewise Linear Classifiers in Data Classification
Adil Bagirov, Dr, Centre for Informatics and Applied Optimization, School of Information Technology and Mathematical Sciences, University of Ballarat, University Drive, Mount Helen, Ballarat, 3353, Australia, a.bagirov@ballarat.edu.au

Algorithms for finding piecewise linear boundaries (PLB) between pattern classes are discussed. We introduce the notion of the max-min separability and nonsmooth optimization algorithms for finding PLBs. In order to reduce complexity in large datasets we use hypeboxes and polyhedral conic functions to identify data points which lie on or close to the boundary and compute a PLB using only those data points. PLBs are computed incrementally starting with one hyperplane.

2 - Integration of Support Vector Machines and Control Charts for Multivariate Process Monitoring
Seoung Bum Kim, Assistant Professor, Korea University, Anam-dong Seongbuk-Gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

We present a novel multivariate control chart that integrates a support vector machines (SVM) algorithm, a bootstrap method, and a control chart technique to improve multivariate process monitoring. A simulation study was conducted to evaluate the performance of the proposed SVM-PoC chart and to compare it with other data mining-based control charts and Hotelling's T2 control charts under various scenarios.

3 - An Implementation of LAD for Large-scale Datasets
Hong Seo Ryoo, Associate Professor, Korea University, 1, 5-Ka, Anam-Dong, Seongbuk-Ku, Seoul, Korea, Republic of, hsryoo@korea.ac.kr, In-Yong Jang

Analyzing large-scale datasets via an optimization-based methodology is a challenging task, owing in part to the requirement for extensive use of memory. In this talk, we develop a memory efficient data comparison scheme to yield an implementation of LAD for analyzing large-scale datasets. With extensive experiments on larger-size datasets from the literature, we demonstrate the utility of the proposed scheme and our implementation of LAD.

■ SD57

H-Room 308, Third Floor

Using Data and Models to Identify Risks and Improve Patient Care

Sponsor: Health Applications
Sponsored Session

Chair: David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

1 - Cost-Effectiveness Modeling and Exploratory Analysis in Medical Decision Making

Megan DeFauw, PhD Candidate, University of Michigan Industrial and Operations Engineering, 1201 Beal Ave., Ann Arbor, MI, 48109, United States of America, mcdefauw@umich.edu, Joseph Norman, Vijayan Nair

Cost-effectiveness analysis is often based on single number summaries such as the ratio of the cost of treatment to gains in quality-adjusted life years. Such simple summaries can hide critical information, such as effectiveness of a treatment for segments of the population, the effects of covariates and subjects' initial health status, and changes over time. We propose data analyses and graphical tools for exploring and discovering interesting information that may be useful to decision makers.

2 - Follow the Money: Analysing Cost in Claims Data for Drug Surveillance

Yihan Guan, Ph.D. Candidate, Department of Management Science and Engineering, Stanford University, Terman 393, 380 Panama Way, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margrét Bjarnadottir

Cost in claims data is a powerful summarizer of the general health status of an insured individual. We build a mathematical framework for monitoring costs to detect adverse events and show that we can detect adverse effects faster than monitoring individual adverse events. We assess the effectiveness of our model using data from 2.4 million insured individuals over 6 years. Our findings have the potential to improve FDA's post marketing prospective drug surveillance.

3 - Optimization Based Data Mining for Cancer Treatments

Allison Chang, Massachusetts Institute of Technology, 70 Pacific Street, Apt. 337B, Cambridge, MA, 02139, United States of America, aachang@MIT.EDU, Cynthia Barnhart, Dimitris Bertsimas

The goal of this work is to be able to identify chemotherapies that show potential for significantly improving the survival time of patients. We use mathematical programming to formulate the problem of ranking the effectiveness of various cancer treatments, and the optimal solutions give insights into the characterization of those treatments with the best results. With this information, we hope to optimize the process of proposing new drug combinations for future clinical trials.

4 - Determining When to Initiate Liver Cancer Screening for Asians with Chronic Hepatitis B

David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

Chronic Hepatitis B is a risk factor for liver cancer. As many Asians are infected with Hepatitis B early in life, liver cancer incidence rises at an earlier age for them. Current guidelines recommend screening Asian men at age 40 and women at age 50. However, many chronic carriers develop liver cancer prior to these ages. We examine historical patterns of liver cancer incidence and use it to analyze the cost-effectiveness of screening for liver cancer at different ages.

■ SD58

H-Room 309, Third Floor

New Developments in Scheduling Studies

Cluster: Scheduling
Invited Session

Chair: Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Dept of Systems Eng & Eng Management, Hong Kong, Hong Kong - PRC, xqcai@se.cuhk.edu.hk

1 - Scheduling with Time-Dependent Machining Costs

Xiangtong Qi, Professor, HKUST, HKUST Academic Building 5540, Kowloon, Hong Kong, Hong Kong - PRC, ieemqi@ust.hk, Guohua Wan

We study a class of new scheduling models where a job scheduled within certain time slots will incur a machining cost which is determined by the length and position of the occupied time slots. Such problems exist when the production cost varies over time. The scheduling objective is to minimize the total machining cost plus a traditional scheduling performance measure. The work is partially supported by Hong Kong RGC under project No. 618807.

2 - Stochastic Scheduling Subject to Multiple-type Machine Breakdowns

Xian Zhou, Professor, Macquarie University, North Ryde, NSW, Sydney, 2109, Australia, xzhou@efs.mq.edu.au

We examine a stochastic scheduling model to schedule n jobs with random processing times on a single machine subject to multiple types of stochastic breakdowns. The aim is to maximize the expected weighted discounted rewards. The optimal policy is tackled by using the multi-armed bandit process in terms of Gittins indices. The optimal policies of some extensively studied models are derived as the applications of the theory developed.

3 - Dynamic Scheduling in a Make-to-Stock System Subject to Machine Breakdowns

Houcai Shen, Professor, Nanjing University, No 22, Hankou Road, Nanjing, China, hcshen@nju.edu.cn

We consider dynamic scheduling in a make-to-stock production system with a single failure-prone machine. The demand with Poisson arrival should be satisfied from on-hand inventory, otherwise it is backlogged with a backlog cost. A scheduling rule specifies when and which item to produce, under the objective of minimizing the expected discounted inventory related cost over an infinite planning horizon.

■ SD59

H-Room 310, Third Floor

Tutorial: 25 Years of Interior Points Methods

Cluster: Tutorials
Invited Session

Chair: Tamas Terlaky, Professor, Chair, Lehigh University, Department ISE, H. Mohler Lab, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu

1 - 25 Years of Interior Points Methods

Tamas Terlaky, Professor, Chair, Lehigh University, Department ISE, H. Mohler Lab, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu

Karmarkar launched the age of IPMs in 1984. Hundreds of polynomial IPMs are designed. IPM software challenged simplex software. Duality theory, strict complementarity, novel sensitivity analysis are explored. New problem classes, e.g. SOCO/SDO are solved. Novel applications, e.g. robust IMRT are solved. Theory and practice of optimization has changed forever. By now, the limits of IPMs are understood. Klee-Minty examples were constructed for IPMs and complexity bound is proved be tight.

■ SD60

H-Room 311, Third Floor

New Advances in Nonlinear Interior Point Methods

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Richard Waltz, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, rwaltz@usc.edu

1 - Penalty Techniques in SQP and Interior-Point Algorithms

Frank Curtis, Lehigh University, Bethlehem, PA, fecurt@gmail.com, Richard Waltz

SQP and interior-point methods form the backbone of contemporary algorithms for NLP. In this talk, we present variants of these approaches that share a common strategy for regularizing the constraints via an exact penalty. We illustrate that penalties — with appropriate updates for the penalty parameter — can be employed to both maintain the convergence properties of an algorithm and improve its practical performance. Our discussion focuses primarily on infeasibility detection and MINLP.

2 - IPM Warmstarts for Single Coefficient Perturbation on the Right Hand Side

Fernando Ordonez, Associate Professor, Daniel J. Epstein Department of Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089-0193, United States of America, fordon@usc.edu, Richard Waltz

A classic branch and bound method requires the solution of a series of problems which differ only in the bound constraint of a variable from a previously solved problem. We formulate this as single perturbations to the righthand side vector and propose a penalty approach. We study theoretical and efficient heuristic methods to reduce the number of IPM iterations of solving the modified problem.

3 - Numerical Experience Using Interior-Point Methods for Mixed Integer Nonlinear Programming

Richard Waltz, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, rwaltz@usc.edu

Interior-point methods are likely to play a more important role in mixed integer nonlinear programming (MINLP) compared to mixed integer linear programming. In this talk, we present some comparative results using interior-point methods in MINLP and discuss current issues related to this.

■ SD61

H-Room 312, Third Floor

Joint Session Location Analysis/ TSL: Discrete Location Analysis

Sponsor: Location Analysis & Transportation Science and Logistics
Sponsored Session

Chair: Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu

1 - An Efficient Approach for Service System Design Problem

Robert Aboolian, Associate Professor, California State University San Marcos, raboolia@csusm.edu, Samir Elhedhli

We consider the service system design problem in a congested network. The problem is set up as a network of M/M/1 queuing systems and modeled as NLIP. Efficient solution approaches under a policy which allocates customers to the facility with minimum access cost are developed. We also examine the efficiency of the solution to this policy compared to the optimal allocation policy.

2 - Empirical Analysis of Ambulance Travel Times: The Case of Calgary Emergency Medical Services

Dawit Zerom, Associate Professor, California State University-Fullerton, Fullerton, CA, 92834, United States of America, dzerom@fullerton.edu, Armann Ingolfsson, Susan Budge

Reducing response times to emergency calls is an important focus of much strategic and operational planning for emergency medical service systems. We estimate how ambulance travel travel times depend on distance using administrative data for one year of high-priority calls in Calgary, Alberta. We illustrate how the travel time distribution model can be used to create probability-of-coverage maps for diagnosis and improvement of system performance.

3 - Error Bound for P-median, P-center or Covering Location Models with Continuous and Discrete Demands

Richard Francis, University of Florida, francis@ise.ufl.edu, Timothy Lowe

We develop an error bound theory to compare a given p-median, p-center or covering location model with continuously distributed demand points to a corresponding given model of the same type having a finite demand point collection. In a precise sense involving only the error bounds, our approach can be viewed as demand point disaggregation.

4 - Single Facility Location Problem with Optimal Construction Timing under Uncertainty

Kyoko Yagi, Dr., The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-0033, Japan, yagi@e.u-tokyo.ac.jp, Ken-ichi Tanaka, Ryuta Takashima

In this paper we present a problem to decide both the location and the construction timing of a single facility under uncertainty in future population growth and the cost of locating the facility. The problem seeks to maximize the expected present value of future return that is determined by the number of customers using the facility. We investigate how the uncertainty affects the optimal location and construction timing of the facility under various assumptions.

■ SD62

H-Room 313, Third Floor

Behavioral Experiments in OM

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg

1 - Temporal Correlation of Lottery Choices and fMRI Imaging

Kay-Yut Chen, Hewlett Packard Laboratories, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com, Tad Hogg, Brian Knutson

Decision theories consider evaluations of utilities to be independent across time. Experiments were conducted where subjects making lottery choices while their brains were scanned with fMRI techniques. We observe a non-trivial correlation of choices over time. fMRI data reveal temporal patterns of neural activations that suggests processes of utility evaluations. We developed a modified version of the quantal response model, with a specific correlation structure across time, to explain the data.

2 - Mental Balancing of Tradeoffs

Sanjiv Erat, University of California San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, serat@ucsd.edu

The concept of tradeoffs is central to much of our thinking of optimal operational decision making. In this presentation, I shall propose and give evidence for a mental heuristic that people employ in managing trade-offs. As an application, I shall also explore the implications of such a heuristic to biases in decision making in the classic newsvendor problem.

3 - Social Preferences, Culture and Performance in Teams

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu, Kishore Sengupta, Ghufran Ahmad

An experimental study shows how problem solving routines (blocks of culture) develop at the micro-level, and how this type of cultural learning is influenced by the social interactions in the team.

4 - Consequences and Control of Present-Bias and Effort Distortion: An Experiment

Karthik Ramachandran, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, karthik@cox.smu.edu, Yaozhong Wu, Vish Krishnan

We report findings from an experiment on the effects of present-bias of individuals on the quality of their performance. The experiment also measures the efficacy of deadlines in managing effort distortion by present-biased individuals, and their contribution to overall welfare of the participants.

■ SD63

H-Room 314, Third Floor

Joint Session OR Bio/HAS: Global Health and Medical Decision Making

Cluster: OR in Biomedicine and Global Health & Health Applications
Invited Session

Chair: Eva Lee, Associate Professor and Director, Georgia Institute of Technology, School of Ind & Sys Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

1 - Resource Allocation for Infectious Diseases
Benjamin Armbruster, Northwestern University, 2145 Sheridan Rd., IEMS C210, Evanston, IL, United States of America, armbruster@northwestern.edu

For an infectious disease, we model the optimal mix of interventions targeting different population groups under a budget constraint. With a short time horizon, the optimal strategy is to focus on the single intervention averting the great number of infections per dollar. With a longer time horizon, the nonlinear dynamics of disease spread become important and interventions previously considered less efficient become part of the optimal strategy. I apply these models to a numerical example.

2 - Disease Propagation Analysis and Mitigation Strategies for Effective Mass Dispensing
Chien-Hung Chen, Graduate Research Assistant, Georgia Tech, Industrial & Systems Engineering Department, Atlanta, GA, 30332, cchen@isye.gatech.edu, Eva Lee

Effective mass dispensing of medical countermeasures is an effective way to contain the outbreak of highly infectious disease. The large influx of individuals brought into the dispensing centers, however, raises the risk of intra-facility cross-infections. For understanding the intra-facility infection, we employ a real-time simulator to analyze the disease propagation within dispensing sites, and show how the results can help mounting an effective monitoring and response against such an event.

3 - Inventory Stockpiling and Sharing for Disaster Preparedness
Elodie Adida, University of Illinois at Chicago, 842 W. Taylor St., Chicago, United States of America, elodie@uic.edu, Po-Ching DeLaurentis, Mark Lawley

We address the problem of stockpiling a medical item in preparation for a disaster such as influenza pandemic. Taking into account the uncertain demand surge under various scenarios, we consider a game theoretical framework that captures the sharing of supplies during a disaster and the community-wide impact of a shortage.

4 - Optimization Strategies for Cancer Treatment Planning
Kyungduck Cha, Postdoc, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, chacha2000@isye.gatech.edu, Eva Lee

Cancer is one of the most common cause of death. In United States, the rate is nearly 1 in every 4. Universally, many patients receive radiation therapy as part of their cancer treatment. In this talk, we will describe various optimization issues and complexity related to cancer treatment. This includes management of competing/conflicting multiple objectives, and changes in tumor shape/position due to organ motion. Computational experience will be discussed.

■ SD64

H-Room 202A, Second Floor

2009 INFORM-ED Case Competition II

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

1 - 2009 INFORM-ED Case Competition
Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

This session will host the presentations of the finalists for this annual competition. A panel of judges from INFORM-ED will select the winners.

■ SD75

C-Room 32A, Upper Level

Next Generation Car Scheduling System II

Sponsor: Railroad Applications
Sponsored Session

Chair: Dharma Acharya, AVP - Operations Research, CSX Transportation, 500 Water St. J315, Jacksonville, FL, 32082, United States of America, Dharma_Acharya@CSX.com

1 - Design of Next Generation Car Scheduling Systems - Lessons Learned From Prior Systems
Carl Van Dyke, Partner, Oliver Wyman, 212 Carnegie Center, 3rd Floor, Princeton, NJ, 08540, United States of America, carl.vandyke@oliverwyman.com

The very first car scheduling systems were created almost 40 years ago. The fundamental capabilities of these systems has not changed significantly over this time period. At the same time, the industry has changed dramatically, with the rise of unit train and intermodal services, which are unsupported by these existing systems. As railways create the next generation of such systems, it is time to look at the lessons of the past 40 years, and factor them into the design of the new systems.

2 - Current and Future Car Scheduling System at BNSF
John Orrison, AVP Service Design and Performance, BNSF Railway Company, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States of America, john.orrison@bnsf.com

In this presentation, we will describe the features of the existing car scheduling system at BNSF. We will also discuss the desired features/functionalities of a future-state car scheduling system.

3 - Computational Results of Several Dynamic Trip Planning Approaches
Ravindra Ahuja, President, Innovative Scheduling, GTEC, 2153 SE Hawthorne Road, Suite 206, Gainesville, FL, 32641, United States of America, ravi@innovativescheduling.com

We believe that dynamic trip planning for railcars can increase a railroad's network capacity significantly without much capital investments. In this presentation, we will present comparative computational results of several dynamic trip planning algorithms on real-life railroad data: (i) a railcar has single/multiple car-block sequences; (ii) a block has single/multiple block-train assignments; and (iii) a railcar's route remains static after arrival or it dynamically changes in route.

Monday, 8:00am - 9:30am

■ MA01

C-Room 21, Upper Level

Innovation at the Frontiers of Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jim Felli, Research Fellow, Eli Lilly & Co., Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, jcfelli@lilly.com

1 - Prioritizing Organizational Shortfalls: 'Gap Analysis' Using Multi-criteria Decision Analysis

Lawrence Phillips, Professor, London School of Economics & Political Science, 1 Ladywell Court, 22 East Heath Road, London, NW3 1AH, United Kingdom, larry_phillips@msn.com

This paper reports a case study of an MCDA approach to 'gap analysis' The method was applied in a decision conference of knowledgeable and senior key players, who used a mixture of performance data and judgment to prioritize key organizational capabilities according to the size and importance of the differences between desired and current performance. This established the key areas for considering measures to close the gaps.

2 - Decision Science and Alliance Management Fusion

David Thompson, Chief Alliance Officer, Eli Lilly & Co., Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, thompson_david_s@lilly.com, Jim Felli

The unlikely blending of Decision Science with Alliance Management results in a powerful tool for gaining clarity around pharmaceutical product development with allied products. The combination of these two disciplines results in a novel approach to gaining an aligned vision for product development, and a unique team building experience.

3 - Thinking Clearly About Decisions

Ralph Keeney, Professor, Duke University, 101 Lombard St., #704W, San Francisco, CA, 94111, United States of America, keeney@duke.edu

The numerous concepts used in decision analyses are essential to clear thinking about any important decision. However, numerous decision makers and individuals who influence important decisions are not aware of or do not understand many of these concepts. This paper specifies several of these relevant concepts, presents cases indicating the lack of understanding of such concepts by decision makers, and suggests the challenges and opportunities for improvement.

■ MA02

C-Room 22, Upper Level

The Role of Some Functional Equations in Decision Analysis and the Impact of Janos Aczel

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu

1 - The Role of Functional Equations in Utility Theory

Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu, Janos Aczel

Functional equations have played an essential role in the characterization of utility and probability functions in decision analysis. We reflect on some equations that have led to the notions of the "delta property", extensions of the delta property to multiple attributes, and the notions of one-switch utility functions and conditional utility independence.

2 - Functional Equations in Individual Decision Theory: Some of Janos Aczel's Impact

Duncan Luce, Distinguished Research Professor, UC Irvine, Social Science Plaza, Irvine, CA, 92697-5100, United States of America, rdluce@uci.edu

Following general remarks about Aczél's interplay with the behavioral and social sciences, the focus turns to roles of functional equations in decision theory. A basic observation is that when two axiomatized structures have a common attribute-in this case, preferences-and each structure yields an order-preserving measure of that attribute, we ask: when are the measures the same measure? This translates into a functional equation. Examples are presented where Aczel's ideas were essential.

3 - The Role of Functional Equations in Probable Inference

Janos Aczel, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, jdaczel@math.uwaterloo.ca

Cox's Algebra of Probable Inference appeared in 1961. Jaynes wrote it is "the most important ever written about the foundations of probability theory and the greatest advance in the conceptual, as opposed to the mathematical, formulation of the theory since Laplace". In 1963 a paper of Aczel appeared, pointing out a small blemish in Cox's book. I describe that blemish and also show why it is not fatal -I also mention a problem of R.D.Luce and its solution with few regularity assumptions.

■ MA03

C-Room 23A, Upper Level

Game Theory for Engineering Systems

Cluster: Game Theory
Invited Session

Chair: Jason Marden, Junior Fellow, California Institute of Technology, M/C 136-93, Pasadena, CA, 91125, United States of America, marden@caltech.edu

1 - On Multi-Dimensional Envy-Free Mechanisms

Ahuva Mu'alem, Junior Fellow, California Institute of Technology, M/C 136-93, Pasadena, CA, 91125, United States of America, ahumu@yahoo.com

We consider fairness design scenarios in which each bidder follows the global goal of the mechanism designer only if the resulted allocation is fair from his own point of view. More formally, we focus on approximation algorithms for indivisible items with supporting envy-free bundle prices. We study the canonical problem of makespan-minimizing unrelated machine scheduling in an envy-free manner. Tight algorithmic bounds are given for the special interesting case of related machines.

2 - Attaining Efficiency with P2P Content Distribution

Srinivas Shakkottai, Assistant Professor, Texas A&M University, 332C WERC, College Station, TX, 77843-3128, United States of America, sshakkot@tamu.edu

Large amounts of traffic exchange between ISP boundaries has caused a misalignment of incentives between P2P networks-that seek to maximize user quality-and ISPs-that seek to minimize costs. We first design an architecture that allows the alignment of such objectives. Second, we study real-time applications requiring distribution of content chunks with delay constraints. We develop chunk selection algorithms that attain such guarantees. Joint with L. Ying, R. Srikant, A.L.N. Reddy, V. Reddy, Y. Kim.

3 - Distributed Welfare Games

Jason Marden, Junior Fellow, California Institute of Technology, M/C 136-93, Pasadena, CA, 91125, United States of America, marden@caltech.edu, Adam Wierman

In the traditional resource allocation problem, there is a global planner who would like to assign a set of players to a set of resources so as to maximize welfare. We consider the situation where the global planner does not have the authority to assign players to resources; rather, players are self-interested. We focus on understanding how the global planner can entice the players to settle on a desirable allocation.

4 - Overcoming Limitations of Game-theoretic Distributed Control

Adam Wierman, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, adamw@caltech.edu, Jason Marden

Recently, non-cooperative game theory has been proposed as a tool for cooperative control. In this work, we prove that this approach has limitations, e.g., we prove that it is not possible to design budget balanced agent utilities that also guarantee that the optimal control is a Nash equilibrium. However, we also demonstrate that these limitations can be overcome by moving to the framework of stochastic games.

■ MA04

C-Room 23B, Upper Level

Procurement Auctions

Cluster: Auctions
Invited Session

Chair: Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu

1 - A Truthful Bundle/Multiunit Double Auction
Leon Chu, leonyzhu@usc.edu

We address the mechanism design problem for a market with multiple buyers and sellers. Each buyer demands bundles of various goods; each seller supplies multiple units of one good. A padding mechanism is proposed to find the buying prices. After that, the selling prices are calculated via a VCG scheme subject to a tariff. To the best of our knowledge, this mechanism is the first strategy-proof, individually rational, weakly budget-balanced double auction mechanism for the specified environment.

2 - Bertrand-Edgeworth Auction with Multiple Asymmetric Bidders
Shanshan Hu, Assistant Professor, Indiana University at Bloomington, hush@indiana.edu, Roman Kapuscinski, William Lovejoy

A unit-price discriminatory procurement auction is equivalent to a Bertrand-Edgeworth (B-E) game with inelastic demand. We characterize the equilibrium structure for B-E auctions with multiple asymmetric bidders. A closed-form solution of mixed-strategy equilibrium is derived for a game with similar bidders, and a numberical algorithm is contructed for more general cases. Numerical studeis illustrate the structural impacts of suppliers' capacities and costs in their procurement bidding.

3 - Reverse Auction Procurement with Flexible Noncompetitive Contracts
Sean Zhou, The Chinese University of Hong Kong, Room 609, William M. W. Mong Engineering, Shatin, N.T, Hong Kong - PRC, zhoux@se.cuhk.edu.hk, Zhijie Tao, Gangshu Cai, Nianbing Zhang

We consider a model that a buyer procures multiple units of a certain product from a group of suppliers. The buyer adopts a hybrid procurement mechanism, in which she first offers some flexible noncompetitive contracts to suppliers followed by a reverse auction. We show that the selected supplier may prefer to accept the offer and the buyer can benefit from offering such contracts

4 - Right of First Refusal (ROFR) in Procurement Auctions
Ali Pilehvar, PhD Student, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20740, United States of America, a_pilehvar@yahoo.com, Manu Goyal, Wedad Elmaghraby

In many procurement auctions, buyers grant the 'right of first refusal' or 'ROFR' to their favored supplier (e.g. incumbent in many cases) rather than selecting the winner based on the lowest bid. Within a simple environment consisting of a buyer and two suppliers (an incumbent and an entrant), we show that such ROFR always hurts the buyer in a single auction. However, with a looming second auction in the future (with the same participating suppliers), the buyer may benefit by granting the ROFR to the incumbent supplier. Our results help explain a commonly seen ROFR in procurement auctions.

■ MA05

C-Room 23C, Upper Level

Joint Session QSR/SIM: QSR and Simulation

Sponsor: Quality, Statistics and Reliability & Simulation
Sponsored Session

Chair: Hong Wan, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, hwan@purdue.edu

1 - Simulation Study of the Response Surface of the Liver Transplantation Allocation Policy
Wen-Hsin Feng, Purdue University, 315 N Grant Street, West Lafayette, IN, 47907, United States of America, wfeng@purdue.edu, Nan Kong, Hong Wan

The liver allocation policy is critical but very complex to develop. We identify four major factors for ranking the patients and propose a single score system to capture alternative prioritization schemes. We simulate the allocation system and incorporate mixture designs to construct response surfaces of different performance measures. This can help the policy makers to systematically comprehend the performance of different policies and explore their robustness upon the environment's changes.

2 - Design of Experiments for Stochastic Kriging
Bruce Ankenman, Professor, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, ankenman@northwestern.edu, Mustafa Tongarlak, Barry L Nelson

Stochastic Kriging is a recently introduced method for creating metamodels for discrete event simulation output. We will study various sequential design strategies to support stochastic kriging. The sequential strategies build on the Latin hypercube designs commonly used for deterministic surface building with ordinary kriging. Since stochastic kriging assumes non-constant variance across the surface, both design point locations and number of replications per design point are considered.

3 - Applied Experimental Design for an Autonomous Search Simulation
Rachel Johnson, Assistant Professor, Naval Postgraduate School, 1411 Cunningham Rd, GL - 253, Monterey, 93940, United States of America, rtjohnso@nps.edu, Timothy Chung

Simulation of persistent surveillance in maritime and land scenarios is used to provide valuable insight about the factors that influence the interception rate of targets. We present an experimental design approach to study the effect of search strategies, false negative and positive detection and identification probabilities, and other factors relevant to autonomous multi-agent systems. The results of the screening experiment will guide field trials for the NPS, USSOCOM program.

4 - Good Experiment Designs for Fitting Forward-Inverse Metamodels
Russell Barton, Professor, Smeal College of Business, Penn State, 406 Business Building, University Park, PA, 16802, United States of America, rrb2@psu.edu, Max Morris

When simulations produce multiple measures of performance, the same set of data used to fit (forward) metamodels may be used to fit approximations for inverse functions as well. Inverse metamodels are useful for product or process design. We discuss measures of goodness and construction strategies for experiment designs that can be used to fit both forward and inverse metamodels.

5 - Multivariate Modeling for Calibration of a Gas Sensor Array
Feng Yang, Assistant Professor, West Virginia University, P.O. Box 6070, Morgantown, 26505, United States of America, fengyang08@gmail.com, Nick Wu

A gas sensor array is a set of sensors typically designed to provide multi-sensor signals for the identification of gaseous analytes. A quantitative relationship between the gas concentrations and sensor signals is desired for the purpose of inferring gas concentrations from sensor responses in practical use. To achieve such high-quality functional relationships in a data efficient manner, design of experiments strategies are developed, and particular statistical inference methods are adopted.

■ MA06

C-Room 24A, Upper Level

IIE Transactions on Quality and Reliability Engineering Sponsored Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jianjun Shi, The Carolyn J. Stewart Chair Professor, Georgia Institute of Technology, 765 Ferst Drive, Room 214, Atlanta, GA, 30332, United States of America, jianjun.shi@isye.gatech.edu

1 - Gaussian Process Method for Form Error Assessment Using Coordinate Measurements
Yu Ding, Associate Professor, Texas A&M University, 3131 MS, College Station, TX, 77843, United States of America, yuding@iemail.tamu.edu, Heidi Xia, Jyhwen Wang

This paper presents a Gaussian process method for modeling and assessing form errors. The GP method models both the systematic and random manufacturing errors of a geometric feature, and provides an empirical distribution of the form error, allowing engineers to quantify the decision risk on part acceptance. Unlike previously proposed GP models, this new modeling approach does not require one coordinate to be expressed as an explicit function of the other coordinates.

2 - Determining the Number of Operational Modes in Baseline Multivariate SPC Data
Hang Zhang, Postdoctoral Research Associate, Bioengineering, Arizona State University, Tempe, AZ, 85281, United States of America, hzhang12@asu.edu, Susan Albin

Manufacturing process may operate under multiple modes due to uncontrollable changes in raw materials or environment. We propose a method to determine the number of operational modes first by identifying the cluster number in baseline. Then SPC model for each mode is built to achieve better performance of online monitoring.

3 - Optimal Specifications for Degrading Characteristics
Roshan Vengazhiyil, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu, I-Tang Yu

In this article, we show that the manufacturing target for a product characteristic affected by degradation is not the value that maximizes the quality of the product. By sacrificing some quality at the manufacturing stage it is possible to increase the product's lifetime and thus reduce the quality loss over a long period. We propose a procedure for finding the optimal manufacturing target that maximizes both quality and reliability of the product.

■ MA07

C-Room 24B, Upper Level

Reliability and Statistics Related to Nanotechnology

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Tao Yuan, Assistant Professor, Ohio University, 270 Stocker Center, Athens, OH, 45701, United States of America, yuan@ohio.edu

1 - Uncertainty Modeling and Model Validation for A Nanoparticle Synthesis Process
Jye-Chyi Lu, Professor, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, 30332-0205, United States of America, jclu@isye.gatech.edu, Hin Kyeol Woo, Justin Vastola, Martha Grover

The current disconnect between the fields of robust design in statistics and mechanistic modeling in engineering will be bridged by the proposed methodology. Stochastic components linking within- and between-batch variations are added into engineering mechanistic models. Statistical models are built for reducing the complexity of the engineering-stochastic models. A methodology of validating the statistical models is developed. The example study focuses on the synthesis of metal nanoparticles.

2 - Implicit Derivative Based Yield Model Considering Nano-Device Process Variations
Tongdan Jin, Texas A&M International University, 5201 University Blvd, Laredo, TX, 78041, United States of America, tjin@tamiu.edu

A mixed-signal device can be modeled as a multi-layer architecture where top-level performance variables are controlled by the process variables at the bottom layer. An implicit derivative based decomposition model is proposed to determine the variance of performance variables based on the mean and the variance at the process level. Compared with simulations or min-max methods, our model reduces the computational time, yet without compromising the estimation accuracy.

3 - Reliability Modeling of Ge/High-k Based MOS Devices
Wilkistar Otieno, Doctoral Candidate, University of South Florida, 4202 E. Fowler Ave, ENB 118, Tampa, fl, 33620, United States of America, wotieno@mail.usf.edu, Geoffrey Okogbaa

Today, attention is shifting from Si/SiO2 to Ge/high-k based MOS technology. The lower effective mass and higher mobility of carriers in Ge compared with Si and the ultra thin stable nanofilms that is attainable when SiO2 is replaced with high-k dielectric material have prompted renewed interest in Ge-based devices. This research will utilize accelerated degradation testing schemes coupled with advanced statistical analysis tools to assess the reliability of Ge-based MOS devices.

4 - Nonparametric Bayesian Reliability and Burn-in Analysis of Nano-scale Memory Devices
Chia-Han Yang, University of Tennessee, 430 Southwest Pkwy, Apt. 1915, College Station, TX, 77840, United States of America, cyang4@utk.edu, Way Kuo, Yue Kuo, Tao Yuan

Technologies for today's design and manufacturing tend to move from the realm of micro- to nano-scale. The scaled technology raises new challenges for burn-in research. This study considers the reliability modeling and analysis of a novel nano-scale memory device. Nanocrystalline ZnO embedded Zr-doped HfO high-k memory devices are fabricated and tested. A nonparametric Bayesian approach based on the stochastic jumping process is used to study the reliability and optimal burn-in of the devices.

5 - Reliability Study for Nano-Scale Gate Dielectrics Considering Film Thickness Fluctuations
Tao Yuan, Assistant Professor, Ohio University, 270 Stocker Center, Athens, OH, 45701, United States of America, yuan@ohio.edu, Xiaoyan Zhu

Dielectric reliability is an essential factor in MOS technologies. As gate oxide approaches its scaling limit, process issues such as poor film uniformity become critical. This paper investigates both the physical and statistical aspects of gate dielectric reliability with the presence of thickness variations. A physics-based simulation model is developed to study the effects of thickness variation on dielectric reliability and a Weibull mixture model is applied to analyze the failure data.

■ MA08

C-Room 24C, Upper Level

Tutorial - Applied Predictive Modelling

Sponsor: Data Mining
Sponsored Session

Chair: Rong Duan, Principle Member of Tech Staff, AT&T, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com

1 - Applied Predictive Modelling
Rong Duan, Principle Member of Tech Staff, AT&T, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com, Tom Au

Predictive modeling has been well studied in research area. But how to utilize these models is still a challenge in the real world applications. In this tutorial, we try to give the whole picture view of what are really involved in the real world predictive modeling work.Start from data collection, data exploration to modeling and model evaluation, in each step, we introduce the possible problems and the solutions. In the case studies, we highlight the problem enchanted and the implementation.

■ MA09

C-Room 25A, Upper Level

Strong Asymptotic Optimality Results in Heavy-traffic

Sponsor: Applied Probability
Sponsored Session

Chair: Baris Ata, Professor, Northwestern University, MEDS Dept - Kellogg School of Management, 2001 Sheridan Road, Evanston, ID, 60208, b-ata@kellogg.northwestern.edu

Co-Chair: Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu

1 - On Optimality Gaps of Asymptotically Optimal Policies in the Many-server Heavy-traffic Regime
Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu, Baris Ata

The optimality gaps in many-server asymptotic optimality results are of the order of the square-root of the demand rate. Our work is concerned with improving these gaps. First, we identify cases under which the emerging asymptotically optimal controls actually induce smaller optimality gaps. For others, we discuss how to modify the limiting diffusion control problem so as to improve on the optimality gap. The results underscore the usefulness of asymptotic analysis for call center applications.

2 - Optimal Call Center Staffing and Routing with Arrival Uncertainty
Achal Bassamboo, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, 60208, a-bassamboo@kellogg.northwestern.edu, Ramandeep Randhawa

We study the capacity sizing and routing problem in a call center faced with an uncertain arrival rate. In a large system setting, we first characterize the solution to the first order fluid problem. We show that the fluid prescription coupled with a quasi-partitioning policy can have an Order-1 optimality property. That is, its optimality gap does not increase with system size.

3 - Dynamic Pricing and Scheduling in a Multi-Class Single-Server Queueing System
Eren Cil, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, e-cil@kellogg.northwestern.edu, Fikri Karaesmen, Lerzan Ormeci

We investigate a sequencing and dynamic pricing problem for a two-class queueing system. Using a MDP based model, we obtain structural characterizations of optimal policies. In particular, we show that the optimal pricing policy depends on the entire queue length vector but some monotonicity results prevail as the composition of this vector changes. On the other hand, our numerical study shows that simple dynamic pricing policies perform well in general.

4 - Refining Square Root Staffing for the Erlang A Model
Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, bozhang@gatech.edu, Johan van Leeuwaarden, Bert Zwart

We consider a useful model of call centers, namely the Erlang A model. We obtain corrected diffusion approximations for main performance measures, and apply them to several constraint satisfaction staffing problems. The proposed refined square root staffing (SRS) rule almost always yields the right staffing level, and is as simple as the conventional SRS. It enables an analytical assessment of the accuracy of the conventional SRS, and allows us to provide practical recommendations.

■ MA10

C-Room 25B, Upper Level

Asymptotic Analysis of Many-Server Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Kavita Ramanan, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States of America, kramanan@math.cmu.edu

1 - Functional Central Limit Theorem for Many Servers Queues
Haya Kaspi, Professor, Technion, Faculty of Industrial Engineering, and Management, Haifa, 32000, Israel, iehaya@tx.technion.ac.il

We consider a G/G/N queueing systems as N becomes large. The Markovian dynamics of the system is presented in terms of a process that describes the total number of customers in the system, as well as a measure valued process that keeps track of the "ages" of the various customers in service. The lecture focuses on a CLT (Diffusion Approximations) of the above pair. The limit is characterized as the unique weak solution of a certain stochastic PDE. Joint work with Kavita Ramanan.

2 - Customer Abandonment in Many-Server Queues
Shuangchi He, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, heshuangchi@gatech.edu, Jim Dai

We study G/G/n+GI queues where patience times are iid with a general distribution. We demonstrate an asymptotic relationship between the abandonment-count and the queue-length processes under the diffusion scaling and some conditions. The key assumption is that the sequence of diffusion-scaled queue-length processes is stochastically bounded. A comparison result is also established to verify the stochastic boundedness by studying a corresponding sequence of systems without customer abandonment.

3 - Convergence of Stationary Distributions of Many-server Queues with Reneging
Weining Kang, Assistant Professor, University of Maryland, Baltimore County, Department of Mathematics & Statistics, Baltimore, MD, 21250, United States of America, wkang@umbc.edu, Kavita Ramanan

We consider a GI/GI/N+GI model. Existence of stationary distributions of the state of such a system is established. Moreover, under the uniqueness assumption on the invariant state of the associated fluid model solution, we show that, as the number of servers goes to infinity, the sequence of stationary distributions for the fluid scaled system states converges to the unique invariant state. We also show some counterexamples when the uniqueness assumption fails to hold.

■ MA11

C-Room 25C, Upper Level

Research From The Daniel Rose Technion-Yale Initiative In Counterterror Operations Research

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Edward H Kaplan, William N and Marie A Beach Prof of Mgt Sciences, Prof of Public Health and Prof of Engineering, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, edward.kaplan@yale.edu

1 - Resource Allocation in a Tactical Arms Race
Moshe Kress, Naval Post Graduate School, Operations Research Department, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, mkress@nps.edu, Boaz Golany, Uriel Rothblum, Michal Penn

We consider an arms race between two opponents where the advantage achieved by one party is mitigated and eventually eliminated when the opposing party develops countermeasures. The problem faced by the defender is how to allocate resources among various countermeasure development projects. We demonstrate the model on a simple, yet current, counterinsurgency situation and also obtain a Nash equilibrium solution for a two-sided setting.

2 - Inference and Interdiction in a Terror Queue Model
Edward H Kaplan, William N and Marie A Beach Prof of Mgt Sciences, Prof of Public Health and Prof of Engineering, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, edward.kaplan@yale.edu

Prior research suggests that HUMINT-driven arrests of terror suspects are responsible for the decline in successful suicide bombing attacks on Israeli civilians. The present analysis presents a new queueing model relating terror threats and their detection by HUMINT agents to understand how preventive counterterror measures and HUMINT combine to interdict terror suspects. We also gauge the number of undetected terror plots in progress from the known utilization of HUMINT agents.

3 - Analysis of a Strategic Terror Organization: Attacks, Evolution, and Counterterrorism Response
Jonathan Feinstein, John G Searle Prof of Economics and Management, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, jonathan.feinstein@yale.edu, Edward H Kaplan

We model a terror organization's choice of the scale and timing of terror attacks when their goal is to maximize their strength over time. The terrorists suffer costs but (for successful attacks) derive benefits in proportion to attack sizes. Terrorists choose among small (one period to plan) and larger (two periods) attacks. We model terrorists' decisions and outcomes depending upon their initial strength, natural recruitment, and the intensity of counterterrorism.

4 - When a Bit More is Too Much: The Cascading Effect of Insurgency Actions on Popular Attitudes
Roberto Szechtman, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, rszechtm@nps.edu, Moshe Kress, Michael Atkinson

Insurgents that operate amid a civilian population need broad popular support in order to thrive. What is the effect of insurgents' actions on popular support? Why does coercion occasionally succeed in preventing antagonists from actively opposing the insurgents and sometimes lead to expanded popular discontent towards the insurgents? How can the sudden changes in popular attitudes towards insurgents observed in recent conflicts be rationalized?

■ MA12

C-Room 26A, Upper Level

Computational Studies Arising in Combinatorial and Stochastic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com

1 - An Efficient Approach for the Reliable Facility Location Problem
Tingting Cui, PhD Candidate, University of California Berkeley, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States of America, tingting@ieor.berkeley.edu, Robert Aboolian, Max Shen

In a reliable facility location problem, candidate locations are subject to unexpected disruptions and customers may be reassiged to facilities further away than their regular facilities. We present an efficient approach that employs neighborhood search and cutting plane algorithms, in order to find optimal facility locations that minimizes the sum of fixed location cost and expected transportation cost.

2 - Lifted Scheme of Stochastic Dynamic Knapsack Polytope in a Parallel Computing Environment
Zhili Zhou, zhilizhou@ou.edu, Yongpei Guan

We investigate the algorithmic and implementation issues for the effective and efficient generation of lifted valid inequalities of stochastic dynamic knapsack polytope in a parallel computing environment. The speedup, communication overhead, load balance, and effectiveness in closing the integrality gap for stochastic dynamic knapsack polytope are studied. The reasonable speedup is shown in computational experiments.

3 - Optimizing Interaction Code Parameters for Zinc Finger, DNA Recognition
Andrew Trapp, Doctoral Student, University of Pittsburgh, Pittsburgh PA, United States of America, Act25@pitt.edu, Alpay Temiz, Oleg Prokopyev, Carlos Camacho

We discuss a particular optimization problem in computational biology regarding protein-DNA interaction decoding. Specifically, we develop a mixed integer non-linear program to decode the interactions of zinc finger transcription factor

mutants, providing insights into how transcription factors identify and bind their targets with high affinity and specificity. We reformulate the initial problem to remove the nonlinearities by using variable substitutions and other modeling techniques.

■ MA13

C-Room 26B, Upper Level

Efficient Computational Approaches to Network Problems

Sponsor: Computing 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 - Integrated Mobile Single Facility Location and Inventory Planning Problems

Tom Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, Department of DSES, 110 Eighth Street, Troy, NY, 12180, United States of America, sharkt@rpi.edu, Jiaming Qiu

We consider the problem of locating and relocating a single mobile facility on a network in order to serve a dynamic set of customers over a finite horizon. The motivating applications of this problem arise in supply chain management and military logistics. We examine this problem under various restrictions on the entities allowed to carry inventory and various objectives, providing efficient algorithms to solve it and construct the efficient frontier for classes with multiple objectives.

2 - Fastest-Path Finding in Direction-Dependent Evolving Media

Irina Dolinskaya, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60208, United States of America, dolira@umich.edu, Robert Smith

Real-time determination of an optimal path in an evolving medium requires explicit incorporation of the cost function's time and space dependency into the model. In our work, we integrate vehicle controllers (such as engine speed) into the decision space of the algorithm and employ optimality properties to develop an efficient path-finding model. Optimal vessel routing within a dynamic sea is used throughout the presentation to motivate this work.

3 - Decomposition Algorithms for Maximizing the Lifetime of Wireless Sensor Networks with Mobile Sinks

Behnam Behdani, University of Florida, 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States of America, behdani@ufl.edu, Cole Smith

We address the problem of maximizing the lifetime of a wireless sensor network with energy-constrained sensors and a mobile sink. The sink travels along discrete locations to gather information from all the sensors. We propose several formulations, and develop a suite of decomposition schemes to solve these problems. Several properties of the sub-problem and master problem are exploited to improve the algorithm. Computational results demonstrate the efficiency of the proposed algorithms.

■ MA14

C-Room 27A, Upper Level

Software for OR/MS II

Sponsor: Computing Society
Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, john@hooker.tepper.cmu.edu

1 - Recent Developments for SIMPL: An Integrated Optimizer

John Hooker, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, john@hooker.tepper.cmu.edu, Tallys Yunes, Ionut Aron

SIMPL is a prototype modeling system and optimizer that integrates mathematical programming, constraint programming, and global optimization in a principled way. It duplicates or surpasses the performance of hand-coded integrated methods with the convenience of a general-purpose solver. We report results on planning, configuration, scheduling, and global optimization problems. SIMPL outperforms commercial MILP and CP software on most instances, sometimes by several orders of magnitude.

2 - The Comet Hybrid Optimization System

Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

This talks presents an overview of the Comet Hybrid Optimization System, its constraint programming and local search solvers and their hybridization with mathematical programming. Its application in vehicle routing, scheduling, sequencing, and timetabling.

3 - Vanguard System - Software for Enterprise Modeling and Simulation

Brian Lewis, VP Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

Vanguard System helps you bring your best OR/MS techniques out of the lab and into the enterprise. Analytics — Monte Carlo Simulation, Forecasting, Optimization, Decision Tree Analysis. Collaboration — Let multiple people contribute to a model at the same time. Web-based — Deliver interactive Web-based applications. Grid Computing — Run Monte Carlo simulations 250 times faster than spreadsheets. Stochastic Optimization — Solve virtually any optimization problem, even problems with uncertainty and non-linear, discontinuous objectives and constraints.

4 - Python Programming Language as a Simulation and Optimization Model Development Platform

Suleyman Karabuk, University of Oklahoma, 202 West Boyd, Norman, OK, 73019, United States of America, karabuk@ou.edu

Python, a general purpose programming language, with its high level native data structures and a wide variety of libraries enables developing integrated simulation/optimization models in the same programming environment at a level of abstraction comparable to using domain specific languages for both modeling tasks at the same time. We illustrate such a development cycle for addressing a transportation problem.

■ MA15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - SAS Education Division - Introduction to ODS Statistical Graphics in SAS 9.2

Tom Bohannon, Higher Education Consultant, SAS Global Academic Program, SAS Campus Drive, Cary, NC, 27513, United States of America, tom.bohannon@sas.com

This paper presents the essential information you need to get started with ODS Graphics in SAS 9.2. ODS Graphics is an extension of ODS (the Output Delivery System), which manages procedure output and lets you display it in a variety of destinations, such as HTML and RTF. Consequently, many familiar features of ODS for tabular output apply equally to graphs. For statistical procedures that support ODS Graphics, you invoke this functionality with the statement ODS GRAPHICS ON. Graphs and tables created by these procedures are then integrated in your ODS output destination. ODS Graphics produces graphs in standard image file formats, and the consistent appearance and individual layout of these graphs are controlled by ODS styles and templates, respectively.

2 - JMP Division - SAS Institute - Dynamic Visualization of Complex Data with JMP

Melodie Rush, JMP Division-SAS, 100 SAS Campus Drive, Cary, NC, 27513, melodie.rush@jmp.com, Mia Stephens

JMP is state-of-the-art data analysis and visualization software from SAS Institute. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. JMP contains a complete array of analytical procedures and always provides dynamic, visual representations alongside their statistical output. This demo will cover an overview of JMP and analysis designed for data visualization including Graph BuilderÆ, Bubble Plots, 3D Scatter Plots and the data filter.

■ MA16

C-Room 28A, Upper Level

Information Technology Impacts

Sponsor: Information Systems
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, N231 BCC, East Lansing, MI, 48824, United States of America, sambamurthy@bus.msu.edu

1 - Environmental Uncertainty and IT Infrastructure Governance: A Curvilinear Relationship

Gautam Ray, University of Minnesota, Dept of IDSC, Minneapolis, United States of America, rayxx153@umn.edu, Ling Xue, Bin Gu

Extant research considers IT governance to be a trade-off between cost-efficiency of centralization and responsiveness provided by local information processing, and predicts decentralization in more uncertain environments. We propose that the relationship between uncertainty and decentralization is a curvilinear relationship i.e., when uncertainty increases from low to high, firms decentralize decisions to the business units, and then centralize decisions as uncertainty increases further.

2 - The Impact of IT-related Spillovers on Long-Run Productivity: An Empirical Analysis

Vijay Gurbaxani, Professor, University of California, Center for Research on IT and Orgs, The Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, VGurbaxa@uci.edu, Young Bong Chang

This paper examines the effects of IT-related spillovers on firm-level productivity improvements over a long-term horizon. We focus on spillovers from inter-industry transactions, especially the IT services industry. We find that spillover impacts are significant but that the magnitude and persistence of the impacts vary with the intensity of IT investment.

3 - Co-diffusion of Wireless Voice and Data Services: The Case of the Japanese Market

Marius Niculescu, Assistant Professor of IT Management, Georgia Institute of Technology, College of Management, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, marius.niculescu@mgt.gatech.edu, Seungjin Whang

This paper explores the parallel market evolution of wireless voice and data services. These services exhibit a stand-alone/add-on relationship. Unlike voice services, data services rapidly evolved over time due to recent advances in interface and data transmission speed and security, and the increase in the content and services ported to the mobile internet space. We also allow for different corresponding consumer learning curves. We empirically test our models on the Japanese wireless market.

■ MA17

C-Room 28B, Upper Level

Information Systems I

Contributed Session

Chair: Sunil Mithas, Assistant Professor, University of Maryland, 4324 VMH U of Maryland, College Park, United States of America, smithas@rhsmith.umd.edu

1 - Customer Satisfaction with Cellphone Services: A Cross-country Analysis

Prasanto Roy, Cybermedia, Cyber House, B35 Sector 32, Gurgaon, 122001, India, pkr@cybermedia.co.in, Sunil Mithas

This study examines customer satisfaction with cellphone services across several countries in several South Asian countries. We study the effect of sales, network availability, value added services, customer care and billing on overall customer satisfaction to determine how these factors affect overall customer satisfaction across countries.

2 - The Analysis of the Software Architecture Using Metrics

Michelle Xiang Liu, Assistant Professor, Marymount University, 2807 North Glebe Road, Arlington, VA, 22207, United States of America, xiangl2001@gmail.com

This study explores a set of metrics to evaluate design architectures of software systems. Design Structure Matrices and networks-based diagrams are adopted to analyze and compare the structure of the Eclipse platform. An empirical study using proposed metrics is elaborated.

3 - Green IT Awareness and Implementation in an Emerging Economy

Sunil Mithas, Assistant Professor, University of Maryland, 4324 VMH U of Maryland, College Park, United States of America, smithas@rhsmith.umd.edu, Prasanto Roy

This study investigates the awareness and implementation of green IT movement in India, a major producer of IT services for the world markets. Based on a survey of more than 200 organizations, we find that cost is a key motivation as well as a hindrance for green IT implementation.

■ MA18

C-Room 28C, Upper Level

Optimization in Practice I - Algorithms

Sponsor: Computing Society
Sponsored Session

Chair: Ernest Forman, Dr., Department of Decision Science, School of Business, George Washington University, Washington, DC, 20052, United States of America, forman@gwu.edu

Co-Chair: Robert Vanderbei, Professor, Princeton University, Sherrerd Hall, Room 106, Princeton, NJ, 08544, United States of America, rvdb@princeton.EDU

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Solving Practical Problems with Hybrid Optimization Approaches

Genetha Gray, gagray@sandia.gov, Katie Fowler, Joshua Griffin

In this talk, we will review the EAGLS (Evolutionary Algorithm Guiding Local Search) software which allows for the hybridization of one or more optimization methods. We will focus on the design characteristics of EAGLS which make it particularly applicable for solving mixed integer problems that arise in hydrological system design.

2 - Determining an Optimal Portfolio of Projects: Project Portfolio Management

Ernest Forman, Dr., Department of Decision Science, School of Business, George Washington University, Washington, DC, 20052, United States of America, forman@gwu.edu, Raj Kanungo, William Taylor

Determining an optimal portfolio of projects involves two phases: prioritizing — developing ratio scale measures of anticipated benefits with respect to an organizations hierarchy of objectives, and determining a combination of projects that maximizes the anticipated benefits subject to dependencies and resource constraints. Three types of risk must also be addressed: business risk, project risk, and portfolio risk.

3 - Combinatorial Optimization Algorithms for Fault Diagnosis in Complex Systems

Krishna Pattipati, krishna@engr.uconn.edu

In this talk, we will first discuss a unified methodology for intelligent diagnostics that judiciously combines hybrid model-based/data-driven/knowledge-based techniques that seamlessly employs quantitative models, machine learning techniques and graph-based dependency models to address real-time diagnosis, test sequencing (NP-hard optimization problems), and remaining life predictions (solution of partial differential equations) as well as the associated maintenance optimization problems.

■ MA19

C-Room 28D, Upper Level

Online Adaptive Routing

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Travis Waller, Associate Professor, The University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78712, United States of America, stw@mail.utexas.edu

1 - Optimal Information Location for Adaptive Routing

Stephen Boyles, Assistant Professor, University of Wyoming, 1000 E. University Ave., Department 3295, Laramie, WY, 82071, United States of America, sboyles@mail.utexas.edu, Travis Waller

Providing real-time travel information with ITS infrastructure is greatly beneficial to drivers, but budgetary and technical constraints limit the number of locations where such information can be provided. The problem of identifying the best locations is studied in three contexts (individual routing, uncongested routing with many drivers, and congested routing with equilibrium), along with discussion of practical issues and performance in realistic-sized networks.

2 - Closed Loop Adaptive On-line Routing under Uncertain Information Reliability in VANETs

Lili Du, Research Associate, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, IN, 47906, United States of America, ldu@purdue.edu, Srinivas Peeta, Yong Hoon Kim, Satish Ukkusuri

Online routing is a key component in decentralized Advanced Traveler Information Systems (ATIS) based on Vehicular Ad Hoc Networks (VANET). This research studies the data fusion and online routing problems under Closed-loop Adaptive Routing (CAR) rule in VANET. Uncertainty of the information reliability provided by VANET in various traffic conditions is addressed.

3 - Trajectory-Adaptive Routing in Dynamic Networks with Dependent Random Link Travel Time

Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu, He Huang

This paper studies the problem of finding the minimum expected travel time trajectory-adaptive routing policies (TARPs) in a stochastic time-dependent network where link travel times are stochastically depedent. Trajectory information is the minimum amount of information available to any traveler. Two equivalent definitions of TARP are given, and in one case Bellman's principle is valid and in the other not. A label-correcting algorithm is designed to find optimal TARPs.

■ MA20

C-Room 28E, Upper Level

Dynamic Vehicle Routing

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Justin Goodson, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, justin-goodson@uiowa.edu

1 - Scenario Tree Based Heuristics for Stochastic Inventory Routing Problems

Lars Magnus Hvattum, Postdoctoral Fellow, Norwegian University of Science and Technology, Alfred getz vei 3, Trondheim, Norway, lars.m.hvattum@iot.ntnu.no, Gilbert Laporte, Arne Lokketangen

We consider stochastic inventory routing problems where, in every period, a set of vehicles can be used to transport cargo from a central supplier to a set of customers. The demand of each customer is stochastic, and is observed after deliveries have been made. The goal is to maximize profits from the cargo delivered subject to inventory costs, transportation costs, and stock-out costs. Heuristics are designed, using scenario trees to represent the stochastics and dynamics of the system.

2 - Dynamic Load Planning for Less-Than-Truckload Carriers

Yang Zhang, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, yzhang2@isye.gatech.edu, Alan Erera, Martin Savelsbergh

We consider the daily dynamic load planning problem faced by LTL carriers, which looks to quickly modify planned operations given actual freight conditions. We propose both integer programming based and heuristic approaches to the problem, and present computational experiments conducted on a rolling horizon and results indicating significant savings for a national carrier.

3 - Dynamic Solutions for the Multi-Vehicle Routing Problem with Stochastic Demand and Duration Limits

Justin Goodson, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, justin-goodson@uiowa.edu, Jeffrey Ohlmann, Barrett Thomas

In the multi-vehicle routing problem with stochastic demand and duration limits (VRPSD), customer demand is known only in distribution prior to arrival at customers. We model the VRPSD as a Markov decision process with an objective of maximizing demand served. We examine a heuristic and an approximate dynamic programming approach that dynamically adjust an initial routing plan as demand is observed. We compare the demand served by dynamic procedures to that served by a priori routes.

■ MA21

C-Room 30B, Upper Level

Freeway and Network Operations

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Xuesong Zhou, Assistant Professor, University of Utah, 122 South Central Campus Dr., CME 210, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Optimizing Queuing Systems with Time-dependent Demand and Service Rates: A Fluid-based Approximation

Xuesong Zhou, Assistant Professor, University of Utah, 122 South Central Campus Dr., CME 210, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Xiaoming Chen

This talk presents the use of a fluid-based approximation approach to represent general queue systems with time-dependent arrival and service rates. Compared to Monte Carlo simulation methods, the proposed computationally efficient model can be further incorporated into a mathematical programming framework to optimize service plans in many transportation queuing systems.

2 - Speed Harmonization and Peak-period Shoulder Use to Manage Urban Freeway Congestion

N. Nezamuddin, Graduate Research Assistant, University of Texas at Austin, 1 University Station 1761, ECJ 6.512, Austin, TX, 78712, United States of America, nezam@mail.utexas.edu, Travis Waller

Speed harmonization and peak-period shoulder use are emerging as advanced traffic management (ATM) strategies to manage congestion on urban freeways in the US. These ATM strategies were implemented on MoPac Expressway in Austin and the resulting operational and safety benefits were assessed.

3 - Empirical Macroscopic Evaluation of Freeway Merge-Ratios

Hillel Bar-Gera, Senior Lecturer, Ben-Gurion University, P.O. Box 653, Beer-Sheva, 84105, Israel, bargera@bgu.ac.il, Soyoung Ahn

An existing theory states that traffic congestion accumulation at merges is dictated by a fixed merge-ratio. We present effective method to estimate merge-ratios from historical traffic data, and apply it to fifteen sites in California using PEMS data. Results show that merge-ratios can be reasonably approximated by lane-ratios, although residual differences suggest that there are probably other influencing factors as well.

4 - Freeway Travel Time Prediction Based on N-Curve and Nearest Neighbor Method

Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Brenda Bustillos

The Nearest Neighbor (NN) method in conjunction with N-curves is proposed for travel times prediction of a freeway corridor. The NN method is a non-parametric method that makes fewer assumptions on the relation between current status travel time and the computed travel time. It aims to find that day in the past which is most similar to the present day in some appropriate sense. Further, we tested two alternatives in terms of k-NN day dependency in a test network.

■ MA22

C-Room 30C, Upper Level

Maritime Transportation

Contributed Session

Chair: Panagiotis Angeloudis, Imperial College London, Skempton Building, London, United Kingdom, pa01@ic.ac.uk

1 - Real-time Yard Crane Deployment Systems for Seaport Container Transshipment Terminals

Matthew Petering, Assistant Professor, University of Wisconsin—Milwaukee, Industrial & Manufacturing Engrg. Department, P.O. Box 784, Milwaukee, WI, 53201, United States of America, mattpete@uwm.edu, F Brian Talbot

We develop several real-time yard crane deployment systems for seaport container terminals and evaluate their performance using a fully-integrated simulation model. The model considers the detailed movement of every container passing through a multiple-berth terminal during a several-week period. It is designed to reproduce the microscopic, stochastic, real-time environment at an actual facility. Performance is measured in terms of the long-run average quay crane rate that can be sustained.

2 - Planning and Optimizing Automated Yard Cranes on Container Terminals

Nils Kemme, University Hamburg, Von-Melle-Park 5, Hamburg, 20146, Germany, nils.kemme@uni-hamburg.de

The performance of automated stacking cranes (ASC) is dependent on strategic decisions on the crane system and the block layout. By means of a simulation study various combinations of block length, width and height are evaluated for four different ASC systems which mainly differ in the number of cranes per block and the passing ability of the cranes. The simulation model considers all crane and container movements in a real-world level of detail for a single yard block in a stochastic environment.

3 - A Construction and Improvement Heuristic for an LNG Inventory Routing Problem

Magnus Stalhane, PhD Student, Norwegian University of Science and Technology, Alfred Getz veg 3, Trondheim, Norway, stalham@iot.ntnu.no, Jorgen Glomvik Rakke

We present a construction and improvement heuristic for a large scale ship routing and inventory management problem for a producer of liquefied natural gas (LNG). The producer has one loading port, a large fleet of ships and a set of long-term contracts for delivery of LNG world wide. The heuristic creates an Annual Delivery Program with the aim of minimizing sailing costs and deviations from contractual demands, while maximizing the profit of selling surplus LNG in the spot market.

4 - Robust Fleet Sizing and Allocation in Industrial and Bulk Ocean Shipping Companies

Panagiotis Tsilingiris, Research Engineer, Det Norske Veritas S.A. Research & Innovation, 26-28 Akti Kondyli, Piraeus, 18545, Greece, Panagiotis.Tsilingiris@dnv.com, Erna S. Engebrethsen, Jose Fernando Alvarez, Nikolaos M. Kakalis

We propose a robust optimization solution to the fleet sizing and allocation problem. We factor in the inherent uncertainty and multi-period nature of the problem. Our approach assists senior managers with varying degrees of risk tolerance in deciding on the sale & purchase, charter-in/out, lay-up, and scrapping of ships as well as the allocation of the active ships to contracts and geographical markets. Preliminary results from a realistic case are presented.

5 - Assignment of Multi-load AGVs under Uncertainty

Panagiotis Angeloudis, Imperial College London, Skempton Building, London, United Kingdom, pa01@ic.ac.uk, Michael Bell

Several methods exist for the control of automated container terminals, but their effectiveness can be affected by the dynamic nature of the environment. We present an assignment method for Multi-Load AGVs that penalises uncertainty and contributes to the quick recovery of the port in the case of equipment failures. Several AGV performance indicators are defined and used in simulations, where it is found that the proposed technique outperforms well-known heuristics and alternative algorithms.

■ MA23

C-Room 30D, Upper Level

Joint Session MAS/SIM: DIME/PMESII Pt 2

Sponsor: Military Applications Society & Simulation
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Developing and Assessing Irregular Warfare Models to Support IED Interdiction and Mitigation

Susan Sanchez, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States of America, ssanchez@nps.edu, Ben Marlin, Adam Larson, Tom Lucas

This project addresses our nation's need to accurately model strategic level contemporary military operations. Specifically, the study provides a thorough qualitative analysis on the Peace Support Operations Model (PSOM) and in doing so outlines a methodology which should be incorporated into the VV&A process for complex combat models that incorporate the Political, Military, Economic, Social, Infrastructure, and Information (PMESII) aspects of irregular warfare.

2 - Towards Culturally-Informed Probative Forecasting of Plausible PMESII Effects

Ken Murray, Senior Computer Scientist, SRI International, 333 Ravenswood Avenue, Menlo Park, CA, 94025, United States of America, murray@AI.SRI.COM, John Lowrance, Janet Murdock

We are developing a decision-support tool that makes use of cultural knowledge while forecasting plausible PMESII effects of DIME COAs in support of SSTR operations. For a candidate COA, the tool applies rules that capture both direct and indirect plausible PMESII effects for entities in a model of the area of operation. Cultural features are used to describe the entities and constrain the effects rules. Forecasts of plausible effects are aggregated into a visual summary for the user.

3 - Irregular Warfare Analysis at the Tactical Level

J. Eddie Edwards, Operations Research Analyst, TRADOC Analysis Center, 1400 Martin Luther King Drive, ATTN: ATRC-WW, White Sands Missile Range, NM, 88002, United States of America, eddie.edwards1@conus.army.mil, Ed Cerer, Ken Brown, Paul Works, Stephen Black

TRAC is developing an Irregular Warfare analytic campaign plan to identify and/or develop a set of analytic capabilities to provide analysis that supports senior leader decisions centered on organizing, equipping, and employing ground forces within an IW environment. This counterinsurgency-based wargame is based on a Task-Event-Outcome (TEO) framework. This presentation discusses the methodology, limitations and constraints, data sources, and example results from a proof of principle use case.

■ MA24

C-Room 30E, Upper Level

Tactical and Operational Models of Irregular Warfare

Sponsor: Military Applications Society
Sponsored Session

Chair: Jeffrey Appleget, Senior Lecturer, Naval Postgraduate School, Operations Research Department, 1411 Cunningham Rd, GL-239, Monterey, CA, 93943, United States of America, jeffrey.appleget@us.army.mil

1 - Irregular Warfare: 3-Year Campaign Plan

Paul Works, paul.works@us.army.mil, Jeffrey (Eddie) Edwards, David Hudak, Leroy (Jack) Jackson, Thomas Cioppa

This briefing outlines the TRAC-led development of a robust Irregular Warfare (IW) Analytic Capability. It addresses the current state of IW analysis capability, describes foundational method, model, and tool (MMT) capability gap identification efforts, and outlines TRAC's plan to mitigate a wide range of those gaps. It outlines partnering agencies, planned capability delivery drops, and the full prototype IW analysis capability to be in place and in use by the end of FY12.

2 - Evaluation of Operational Level Irregular Warfare Models and Simulations

Bill Krondak, Director, Scenarios and Wargaming, U.S. Army TRADOC Analysis Center, 255 Sedgwick Avenue, Fort Leavenworth, KS, 66027-2345, United States of America, william.krondak@us.army.mil, Kerry Lenninger, David Lindow

TRADOC Analysis Center (TRAC) reviewed models, methods, and simulations for analysis of stability operations and irregular warfare. TRAC acquired two models for further evaluation, the Integrated Gaming System and the Peace Support Operations Model. This paper discusses the review that led to evaluation of these models, the implementation of specific scenarios, findings of the evaluation, and perspectives on the acquisition and integration of relevant social, cultural, and economic data.

3 - The Problem of Problem Framing in Complex Operations Models

Karen Guttieri, Assistant Professor, Naval Postgraduate School, 1441 Cunningham Road, GE-306, Monterey, CA, 93943, United States of America, guttieri@nps.edu

The Problem of Problem Framing in Complex Operations Models Internal conflicts, including insurgency, are pernicious, contagious, prevalent, and expected to become more so as financial and environmental crises displace and deprive populations. Prevention is an imperative for practical, doctrinal, and - in the event of genocide - normative reasons. Political and military decision makers, supported by operations researchers, must better understand social structures and processes that are commonly hidden from view - how societies interpret change. Models may help depict and anticipate the emergence of violent extremism and to determine governance needs for contested terrain. This paper draws upon multiple social disciplines to assess the state of the modeling art. A proactive posture for conflict management requires a conceptual shift, particularly regarding problem framing and analysis. Research on insurgency, now revitalized after a long period of neglect, still lacks for a working model of origins; practitioners and analysts are predominantly focused on situations that are already violent. Large number quantitative studies and country-level data fail to provide the granularity we need to understand social dynamics. The paper suggests a multi-level approach to addressing these gaps so we might better determine conditions upon which pivotal events trigger the political violence.

4 - Athena - Spiral 1 with Emphasis on the Economics Model

Robert G Chamberlain, Principal, Jet Propulsion Laboratory, M/S 144-210, 4800 Oak Grove Dr, Pasadena, CA, 91109, United States of America, rgc@jpl.nasa.gov, Leila Meshkat

The Athena simulation addresses long-term stability & reconstruction operations. All elements of power are considered; gaining the support of the population is essential to success. Athena contains models of politics, use of assets, conflict, civilian attitudes, demographics, information ops, intelligence, and economics. A social accounting matrix organizes the flows of value between economic sectors and a computable general equilibrium model determines economic consequences of actions taken.

■ MA25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Aircraft Maintenance Routing & Logistics

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Ram Gopalan, Temple University, 517, Alter Hall, School of Business, Philadelphia, PA, 19122, United States of America, gopalan@temple.edu

1 - The Impact of Aviation Checkpoint Queues on Security Screening Effectiveness

Adrian Lee, University of Illinois, 201 N. Goodwin Ave, Urbana, IL, 61801, United States of America, ajlee4@illinois.edu, Sheldon Jacobson

Despite recent technological advancements that improve the detection rate of threat items within an aviation security screening checkpoint, the average amount of time it takes to appropriately screen a passenger remains a concern. Queueing models for multi-level and selective security systems are presented, where optimal passenger assignment policies are obtained to maximize security and passenger throughput by effectively utilizing a set of available screening resources.

2 - Building Lines of Flight for Improved Maintenance Robustness

Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu, Marcial Lapp, Jaime Ibarra, Alex Heinold

Airlines build lines-of-flight that dictate the sequence of flights an individual aircraft will fly over the course of a day. Lines-of-flight that terminate at a maintenance facility provide greater opportunity for recovering from unexpected maintenance requirements. We present methods for modifying existing lines-of-flight to create lines with an increased probability of being able to overnight at a maintenance station if needed. We present extensions from results shown at CORS.

3 - The Aircraft Maintenance Base Location Problem

Ram Gopalan, Temple University, 517, Alter Hall, School of Business, Philadelphia, PA, 19122, United States of America, gopalan@temple.edu

In order to perform FAA-mandated maintenance checks, aircraft must be routed so as to remain overnight at a maintenance base every k days, with k usually being 3 or 4. This paper examines the complementary strategic problem of locating the minimum number of maintenance facilities in an Eulerian graph so as to enable all aircraft to fulfill the FAA requirements for periodic maintenance visits. A number of approximation algorithms for this problem will be presented.

■ MA26

C-Room 31B, Upper Level

Panel Discussion: Certification Process for OR/MS Professionals

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Michael McCoy, Dr., The Boeing Company, michael.s.mccoy@boeing.com

1 - Certification Panel

Moderator: Michael McCoy, Dr., The Boeing Company, michael.s.mccoy@boeing.com

An Operations Research/Management Science Certification panel session will be conducted in which panel members will describe their vision of certification, the Credentialing process that would be used to evaluate and award certification, and the benefits of certification to the Operations Research community, Academic Institutions, Industry and Government and most importantly to the practitioners who apply for and receive the certification. This panel will also allow members to discuss issues and concerns as well as present new ideas to be considered by the Certification committee.

■ MA27

C-Room 31C, Upper Level

Supply Chain Simulation I

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States of America, son@sie.arizona.edu

1 - Sequential Monte Carlo Fidelity Selection In Dynamic-Data-Driven Adaptive Multi-Scale Simulations

Nurcin Celik, PhD Candidate, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85719, United States of America, nurcinkoyuncu@gmail.com, Young-Jun Son

In Dynamic-Data-Driven Adaptive Multi-Scale Simulations (DDDAMS), the fidelity of a complex simulation model adapts to available computational resources by incorporating dynamic data into the executing model, which then steers the measurement process. In this work, a Sequential Monte Carlo method is proposed and embedded into the simulation to enable its ideal fidelity selection. A prototype DDDAMS involving the proposed algorithm is successfully implemented for a semiconductor supply chain.

2 - Modeling of a Mass Customized Satellite Production System

Roberto Lu, Boeing, roberto.f.lu@boeing.com, Edward Shroyer, Lorrie Sivich, William Zanteson

There are products can be repaired and maintained after they were produced, such as automobiles, etc. There are products next to impossible to be repaired and maintained after they were produced and in service, such as satellites. Satellite is a customized product with high complexity. Satellite production system has unique features that emphasize on 100 percent successful deployment and functionality in space. The production volume maybe low as compared to automobiles, the level of customization, however, is not. This presentation discusses some of the modeling techniques and challenges in simulating a mass customized satellite production system.

3 - Stabilization of the Supply Chain by Using a Policy Optimization Approach

Alfonso Sarmiento, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States of America, sarmient@mail.ucf.edu, Luis Rabelo, Albert Jones

This presentation will discuss a methodology to perform stability analysis of the supply chain. Achieving stability requires the solution of a policy optimization problem. This problem relies upon a theorem that states ADE (Accumulated Deviations from Equilibrium) convergence of a state variable of the system implies asymptotic stability for that variable. A hybrid algorithm based on Particle Swarm Optimization and Powell Hill-Climbing techniques is used to find the stabilization policy.

4 - Automatic Partitioning of Large Scale Simulation in Grid Computing for Run Time Reduction

Esfandyar Mazhari, PhD Student, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States of America, emazhari@email.arizona.edu, Nurcin Celik, Young-Jun Son

We intend to reduce execution time of large-scale simulations by partitioning a monolithic model into multiple pieces and executing them in a grid computing environment. A method is proposed to minimize the simulation execution time considering internal computation in each partitioned mode and their time synchronizations. Also, we seek to find the most advantageous number of partitioned models by evaluating tradeoff between reduced computations vs. increased time synchronization requirements.

■ MA28

H-Room 500, Fifth Floor

Panel Session: Teaching Revenue Management and Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Moderator: Robert Phillips, Professor, Columbia University Business School, Uris Hall 408, 3022 Broadway, New York, NY, 10027, United States of America, rp2051@columbia.edu

1 - Teaching Pricing and Revenue Management

Panelists: J. Michael Harrison, Nicola Secomandi, Robert Shumsky, Costis Maglaras

Four professors who have been leaders in developing and teaching pricing and revenue management courses will discuss their experiences with what works and doesn't work in teaching this topic and give their thoughts on its place in the business school and management science curricula.

■ MA29

H-Room 501, Fifth Floor

Decisions Analysis and Risk Management in Energy Markets with Applications to Renewable Energy Projects

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

1 - Insuring Unit Failures in Electricity Markets
Antonio J. Conejo, Professor, University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, antonio.conejo@uclm.es, Salvador Pineda, Miguel Carrion

A power producer trading in the futures market is required to supply its contracted energy even if some of its production units are unavailable. In such case, the producer must buy in the pool some of the contracted energy, which may result in a significant loss. To mitigate such loss, the producer can take out insurance against unit unavailability. Using a stochastic programming model, this presentation analyzes the convenience of signing such insurance and its impact on forward contracting.

2 - Evaluation of Power Storage Facilities with a Real Options Approach
Dogan Keles, Universität Karlsruhe, Hertzstr. 16, Karlsruhe, 76187, Germany, dogan.keles@wiwi.uni-karlsruhe.de, Wolf Fichtner, Dominik Moest

Energy utilities are facing several uncertainties in liberalised markets. In this paper these uncertainties are modelled with time-series models such as ARMA-processes. The simulated price paths are used in a stochastic model, to optimize the plant dispatch for a pump-storage or CAES-plant. Thereby the calculated real options value considers the value of flexibility. Results of the stochastic model are compared with a deterministic calculation, to point out the impact of uncertain parameters.

3 - Optimal Hedging Contract Structures for Wind Developers
Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

To secure financing, wind project developers need to sign long-term hedging contracts (with fixed electricity selling prices and quantities) with third parties to. For merchant wind plants, locking into a fixed revenue stream may forgo higher profits that could otherwise be earned through participating the spot electricity market. A stochastic optimization framework is proposed to obtain optimal contract structures for wind developers, subject to a fixed rate-of-return constraint.

■ MA30

H-Room 502, Fifth Floor

Forestry III: Fire Management

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Spatio-Temporal Arson Clusters
Douglas Thomas, National Institute of Standards and Technology, Gaithersburg, MD, United States of America, douglas.thomas@nist.gov, David Butry

Many arson incidents are clustered in space and time, which stretches fire services thin. These clusters are highly correlated with the day-to-day activities of people, making them predictable and preventable. Understanding these event-driven incidents will allow police and fire services to take actions to prevent and prepare for clustered arson incidents. This paper characterizes these types of arson events so to reduce their impact on society.

2 - Addressing Sources of Uncertainty in Strategic Fire Planning
Matthew Thompson, U.S. Forest Service Rocky Mountain Research Station, 800 East Beckwith Ave, Missoula, MT, 59801, United States of America, mpthompson02@fs.fed.us

Strategic fire planning is subject to manifold sources of uncertainty. Beyond the unpredictability of wildfire behavior, uncertainty stems from inaccurate/missing data, poor scientific understanding of ecological response to fire, and relative prioritization of non-market resource values. This work attempts to systematically align sources of uncertainty with the most appropriate decision-support methodologies, in order to facilitate cost-effective, risk-based wildfire planning efforts.

3 - Stochastic Programming Models for Wildfire Initial Attack Planning
Julian Gallego, PhD Student, Texas A&M University, 241 Zachry, TAMU 3131, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Lewis Ntaimo

We present two stochastic programming models for initial attack: standard response model (SRM) and explicit fire growth response model (ERM). The SRM assumes a known standard response needed to contain a fire of given size, while the ERM considers fire behavior characterized as fire perimeter and burned area at discrete time intervals over the initial response period. Computational results based on one of the Texas Forest Service fire planning unit in East Texas will be presented.

4 - Generating Efficient Solutions on a Nondominated Frontier for Analysis of Wildfire Management in US
Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com, Gyana Parija, Steven Carty, Andy Kirsch, Soujanya Soni

We present a multi-criteria budget allocation model for assigning national budgets across Fire Planning Units (FPU) in the US. The model generates a set of efficient solutions for the decision maker to select a preferred alternative. We discuss challenges faced by the decision maker in choosing a set of weights due to the correlation among the objectives. We review the current approach, discuss future improvements, and present results using the national analysis data for budget year 2011.

■ MA31

H-Room 503, Fifth Floor

New Frontiers in Dynamic Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Georgia Perakis, Professor, Sloan School, MIT, 50 Memorial Drive Building E53-389, Cambridge, MA, United States of America, georgiap@MIT.EDU

1 - Towards a Data-Driven View of Customer Choice
Vivek Farias, Assistant Professor, MIT Sloan School, E53-317, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, vivekf@mit.edu, Srikanth Jagabathula, Devavrat Shah

Given the importance of understanding customer choice behavior and the risks of incorrectly modeling such behavior in applications, we visit the following fundamental problem: For a 'generic' model of customer choice and a limited amount of data on how customers actually make decisions how may one predict revenues from offering a particular assortment of choices? We present a framework to answer such questions and design a number of tractable algorithms for the same.

2 - Multi-Product Pricing under Attraction Demand Models
Philip Keller, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge MA, United States of Americapkeller@mit.edu, Retsef Levi, Georgia Perakis

We consider a multi-product pricing problem under the multinomial demand model. The problem is non-concave and hence solving it efficiently is an issue. An added difficulty to the problem arises also due to capacity constraints shared among products. We illustrate its efficient solution in theory as well as by conducting numerical experiments to contrast the proposed algorithm with other approaches. We also consider its extension to more general attraction models.

3 - Dynamic Incentives for Adoption of Renewable Energy Technology
Ruben Lobel, MIT, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge MA, United States of America, rlobel@mit.edu, Georgia Perakis

We model the adoption of renewable technology as a diffusion process with rates depending on the incentives offered to the customers (eg. rebates for buying a plug-in hybrid or a photovoltaic cell). An electricity retailer offers these rebates and profits from each customer who adopts the new technology. We design optimal dynamic incentives that the retailer should offer to stimulate the technology diffusion over time while maximizing revenues.

4 - Dynamic Pricing in an Evolving Marketplace
Yiwei Chen, Massachusetts Institute of Technology, Cambridge, United States of America, ywchen@mit.edu, Vivek Farias

We consider the generic dynamic pricing problem allowing the 'scale' of demand intensity to be modulated by an an exogenous 'market size' stochastic process. This is a natural model of dynamically changing market conditions. We show that for a broad family of market size processes (namely, diffusions analogous to 'moving average' processes), simple dynamic pricing rules that are *agnostic* to the statistics of this market size process perform provably well.

■ MA32

H-Room 504, Fifth Level

Advanced Portfolio Theory and Practice

Cluster: Financial Engineering
Invited Session

Chair: John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

1 - Portfolio Theory versus Financial Engineering and Their Roles in Financial Crises

Harry Markowitz, Harry Markowitz Company, 1010 Turquoise Street, Ste. 245, San Diego, CA, 92109, United States of America, harryhmm@aol.com

Both mean-variance analysis (also known as MPT) and financial engineering which develops products and procedures based on the Black-Scholes equation and its generalizations, use mathematical techniques to advise (individual or institutional) investors. However, their effects have been quite different on the stability of the stock market and the safety of their followers.

2 - Value-at-Risk vs. Conditional Value-at-Risk in Risk Management and Optimization

Stan Uryasev, University of Florida, Department of Industrial and Systems Engineer, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, uryasev@ufl.edu

From the mathematical perspective, risk management is a procedure for shaping a risk distribution. Two popular risk measures are Value at-Risk (VaR) and Conditional Value-at-Risk (CVaR). This paper presents our personal experience working with these key percentile risk measures. We explain strong and weak features of these risk measures. We discuss related case studies conducted with the Portfolio Safeguard package.

3 - Managing a Fixed-income Portfolio

Roger Wets, Professor, University of California, Davis, EpiRisk Research, CA, United States of America, rjbwets@epirisk.com

As stressed by Markowitz in the early 1950s and many others since, investors can't ignore risk. This has led to widely implemented mean-variance models. This lecture describes an alternative approach relying on i) a more comprehensive description of uncertainty that takes into account historical and market (term structures) information and, ii) on an approximate assessment of the manager's risk aversion whose parameters can be (easily)adjusted based on the(projected) distribution of returns.

■ MA33

H-Room 505, Fifth Floor

Operations and Finance Interface

Cluster: Economic Models in Operations Management
Invited Session

Chair: Lingxiu Dong, Washington University in St. Louis, Olin Business School, 1 Brookings Drive, St. Louis, MO, 63130-4899, United States of America, dong@wustl.edu

Co-Chair: Jiri Chod, Boston College, Carroll School of Mgmt, Fulton Hall 452B, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, chodj@bc.edu

1 - Optimization of Inventory and Dividends with Risky Debt

Danko Turcic, Assistant Professor of Operations and Manufacturing Management, Washington University in St. Louis, Olin Business School, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu, Qiaohai Hu, Matthew J. Sobel

We analyze a dynamic stochastic model of a firm that coordinates operational and financial decisions and is partially financed with short-term and long-term debt. We also analyze a similar firm, which decentralizes its decisions. Assuming that bankruptcy triggers liquidation of the firm, we show that the coordinated firm has higher inventories, larger short-term and long-term debts, and issues greater dividends than the decentralized firm.

2 - Signaling Manufacturer's Private Information through Operational Decisions and Trade Credit

Pierre-Yves Brunet, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, brunetp@umich.edu, Volodymyr Babich

We consider a signaling game among manufacturers, suppliers, and banks in which manufacturers can signal their knowledge of demand distribution by their operational decisions and financing choices. We describe separating and pooling equilibria and study the role of trade credit as a signaling tool and its interactions with operational decisions. Interestingly, the total order quantity could be higher in the economy without trade credit.

3 - The Newsvendor Problem and Price-only Contract When Bankruptcy Costs Exist

Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu, Wenhui Zhao

We study a supply chain of a supplier and a capital constrained retailer with the accessibility to a break-even bank loan. Failure of loan repayment leads to a costly bankruptcy. We identify the retailer's optimal order quantity as a function of the wholesale price and his total wealth (working capital & collateral). The analysis of the supplier's problem as a Stackelberg game leads to unique solutions in wholesale price and order quantity smaller than the traditional newsvendor order quantity.

4 - Operational Flexibility and Financial Leverage

Jiri Chod, Boston College, Carroll School of Mgmt, Fulton Hall 452B, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, chodj@bc.edu, Jianer Zhou

We consider a two-product financially-constrained firm that has to choose the optimal mix of flexible and dedicated capacities as well as the optimal level of external financing while facing demand uncertainty. We study the relationship between the firm's mix flexibility and financial leverage, and how it is impacted by the bankruptcy cost and agency conflict between shareholders and bondholders.

■ MA34

H-Room 520, Fifth Floor

Research Issues for OEM Remanufacturing

Cluster: Green Supply Chain
Invited Session

Chair: Daniel Guide, Associate Professor, Penn State University, 464 Business Building, University Park, PA, 16802, United States of America, dguide@psu.edu

1 - Research Issues for OEM Remanufacturing

Daniel Guide, Associate Professor, Penn State University, 464 Business Building, University Park, PA, 16802, United States of America, dguide@psu.edu, Luk Van Wassenhove

We present an overview of key research issues for OEMs that engage in remanufacturing and/or product recovery. Our discussions are based on a recent round table and projects with several OEMs.

■ MA35

H-Sapphire A, Fourth Floor

Healthcare Management - Planning II

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - Bayesian Analysis of Discrete Time Queues with a Healthcare Application

Toros Caglar, The George Washington University, 2201 G Street NW, Funger 415, School of Business, Washington, DC, 20052, United States of America, toros@gwu.edu, Refik Soyer

Discrete time queues have mostly been analyzed in the context of computer and communication systems. In this study, we aim to utilize a Bayesian approach for the analysis of discrete time queues in a healthcare management setting. We focus on the Geo/Geo/1 queue, and obtain posterior distributions of the system parameters and performance measures using conjugate priors. With this framework, we also provide a numerical example using emergency department arrival and service data.

2 - Integration of Simulation Modeling into Hospital Pharmacy Delivery Network Planning

Beilei Zhang, University of Missouri, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, bztdd@mizzou.edu, Kalyan Pasupathy

This project aims at optimizing internal pharmacy supply chain network by using a hybrid modeling approach combining simulation and mathematical modeling, such that supply chain "5Rs" can be integrated and quantified. The simulation modeling is used to build stochastic scenarios and conduct performance report, while the mathematical model defines networking strategies for each scenario. By comparing different performance reports, the most suitable networking strategy can be identified.

3 - Dynamic Performance Evaluation System for Patient Controlled Analgesia Program

Jy Yu, NTU, Department BA, 9F, Management Building 1, 1, Sec. 4, Roosevelt Road, Taipei, 106, Taiwan - ROC, jyyu@ntu.edu.tw, Jo-Lin Tsao

The Department of Anesthesiology at a leading national hospital is planning to renovate its currently under-productive patient controlled analgesia program (PCA) for patients after surgical operations. In this study, a performance evaluation scheme for PCA is proposed base on Balance Scorecard (BSC). To take account of the interweaving causalities embedded in practice, an integrated dynamic BSC is developed with System Dynamics, based on which the key performance indicators are identified.

■ MA36

H-Sapphire B, Fourth Floor

Quantitative Analysis of Medical Signal Data

Sponsor: Health Applications
Sponsored Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

1 - A New Approach for the Identification of Cardiac Disorders

Hui Yang, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, huiyang@eng.usf.edu, Satish Bukkapatnam

Cardiovascular diseases are the leading causes of mortality in the world. This paper presents a novel spatial octant-wise analysis of vectorcardiogram (VCG) loops for the identification of various types of myocardial infarction (MI). This study reveals that significant spatial distribution differences exist between MI and healthy control (HC) groups and octant features can distinguish MIs from HCs with a sensitivity of 97.28% and a specificity of 95.00%.

2 - Diagnosis of Wegener's Granulomatosis Using Predictive Modeling Techniques

Vladimir Boginski, University of Florida, REEF, 1350 N Poquito Road, Shalimar, FL, 32579, United States of America, boginski@reef.ufl.edu

Optimization-based data mining techniques were utilized for the analysis of the Wegener's granulomatosis patient dataset, and accurate diagnosis outcomes were obtained using the constructed mathematical models. Specifically, using the Smooth Support Vector Machine (SSVM) models, we were able to achieve high prediction accuracy on the considered patient dataset.

3 - Reinforcement Learning Framework for Seizure Prediction

W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu, Shouyi Wang, Stephen Wong

In this talk, we present a new paradigm of seizure prediction based on quantitative analyses of brainwave recordings (i.e., electroencephalograms) that employs advances in reinforcement learning, pattern recognition and time series analysis. The results suggest that the new paradigm is promising and can be applied to other event prediction problems.

■ MA37

H-Sapphire C, Fourth Floor

Health Care Value Chain Optimization

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Stefanos Zenios, Professor, Stanford University, 518 Memorial Way, Stanford, United States of America, stefzen@stanford.edu

1 - Post-Marketing Drug Surveillance

Margrét Bjarnadottir, Assistant Professor of Operations, Information and Technology, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States of America, margret@stanford.edu, Stefanos Zenios

After the withdrawal of Vioxx from the pharmaceutical market in 2004, post-FDA-approval drug safety and surveillance has come under serious scrutiny. We build a mathematical framework for a real-time drug surveillance system based on the use of claims-data. We report both some analytical and empirical results. Our work shows that a successful drug-surveillance system can be built, based on claims data analysis and could become one of FDA's standard tools for post-marketing surveillance.

2 - Performance Contracting for Outpatient Medical Services

Sergei Savin, The Wharton School, 3720 Walnut Street, Philadelphia, PA, 19104, United States of America, svs30@columbia.edu, Houyuan Jiang, Zhan Pang

Both mean-variance analysis (also known as MPT) and financial engineering which develops products and procedures based on the Black-Scholes equation and its generalizations, use mathematical techniques to advise (individual or institutional) investors. However, their effects have been quite different on the stability of the stock market and the safety of their followers.

3 - Pharmaceutical Promotion with Leakage under a Pharmaceutical Price-volume Agreement

Hui Zhang, Assistant Professor, Lakehead University, 955 Oliver Rd., Thunder Bay, ON, P7B5E1, Canada, hzhang2@lakeheadu.ca, Greg Zaric

Formularies may list drugs that have been approved regulatory authorities. However, once a drug is approved there can be "leakage" to unapproved or "off-label" indications. Some third-party payers use price-volume agreements to control unspecified drug uses. We take a game theory perspective to investigate the impact of price volume agreements on promotional effort and leakage.

4 - Capacity Planning and Process Configuration in Radiation Therapy

Vincent Chow, BC Cancer Agency, 600 West 10th Avenue, Vancouver, Canada, vchow@bccancer.bc.ca, Martin Puterman, Pablo Santibanez

We present a model of Radiation Therapy treatment to understand the relationships between patient access, process configuration and capacity decisions. We consider scenarios such as changes in patient mix, treatment techniques (clinical practice) and resource availability. We measure performance in terms of access (patient wait times) and efficiency (resource utilization). In this presentation we show applications of this model within the Radiation Therapy program at the BC Cancer Agency.

■ MA38

H-Sapphire D, Fourth Floor

Fighting Supply Uncertainty: Guaranteeing, Dual Sourcing, Emergency Ordering and Transshipping

Cluster: Inventory Management
Invited Session

Chair: Metin Cakanyildirim, University of Texas at Dallas, UTD School of Management, SM30, Richardson, TX, 75083-0688, United States of America, metin@utdallas.edu

1 - The Role of Supply Guarantees in the Face of Capacity Uncertainty

Haresh Gurnani, Professor, University of Miami, 5250 University Drive, Coral Gables, FL, 33146, United States of America, hgurnani@exchange.sba.miami.edu, Saibal Ray, Mehmet Gumus

In this work, we model a supply chain that consists of a buyer and two suppliers. First supplier has unlimited capacity, whereas the second one has capacity uncertainty. Buyer needs to allocate a fixed amount to these suppliers and will use spot market if total production is less than what is ordered. In this context, we examine the role of supply guarantees in symmetric and asymmetric information cases.

2 - An RFID-enabled Emergency Ordering Policy

Gary Gaukler, TAMU, TAMU-3131, College Station, TX, United States of America, gaukler@tamu.edu

In this research, we attempt to model the value of supply chain visibility in improving inventory control policies. We consider a global supply chain with stochastic resupply lead times and order progress information provided by RFID checkpoints. We derive a new policy for emergency ordering based on supply chain visibility and evaluate the impact on supply chain cost.

3 - Transshipment Prices

Metin Cakanyildirim, University of Texas at Dallas, Dallas, TX, metin@utdallas.edu, Nagihan Comez, Kathryn Stecke

A common method of inventory sharing among independent retailers is retailer-to-retailer trade, called transshipment. When a unit of inventory is shipped from a retailer to another retailer, the receiving retailer pays a transshipment price to the sending retailer. We examine how these prices are determined and also how they can be determined with a dynamic inventory model.

■ MA39

H-Sapphire E, Fourth Floor

Managing Product Rollovers

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Svenja Sommer, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Paris, France, sommers@hec.fr

1 - Modeling Aircraft Upgrades in a Closed Loop Supply Chain
Ananth Iyer, Purdue University, aiyer@purdue.edu, Asima Mishra, Vinayak Deshpande

We present an aircraft rolling upgrade problem context at the US Coast Guard. An associated model of the upgarde process consists of two closed loop supply chains, representing components and aircrafts. Analysis of the model shows how the mix of product types can be adjusted to compensate for component availability constraints. Data from the US Coast Guard are used to suggest the impact of such flexible use of product configurations in the system.

2 - Sequential Innovation under Development Uncertainty: Inventory and New Product Launch Decisions
Sreekumar Bhaskaran, Asst. Professor, SMU-Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@cox.smu.edu, Ankur Goel, Karthik Ramachandran

We look at the inventory planning and introduction timing decisions surrounding product rollovers in sequential innovation when a firm faces uncertainty regarding the outcome of a new product development endeavor. We characterize the product launch timing decision as the optimal recourse to observed new product quality and current product inventory. Effect of emergency option and competition are also analysed.

3 - Time to Market for Closed Loop Supply Chains
Andreas Robotis, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Jouy en Josas, 78351, France, robotis@hec.fr

In the last decade, environmental awareness in Europe has skyrocketed. Green, closed loop supply chains have become a political and business priority. However, closed loop supply chains impose additional restrictions on product design and manufacturing, which might imply longer time to market in new product development. Using industry data we examine the difference in the time to market for companies that operate closed loop supply chains in comparison with those that operate open loop ones.

4 - Product Rollover Decisions During Regulatory Changes
Svenja Sommer, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Paris, France, sommers@hec.fr, Mohammad Saoud, Ananth Iyer

New environmental regulations are imposing increasingly strict standards on manufacturers, requiring them to redesign products and cease producing older versions by a specific date. We consider the technology choice made by the manufacturer during redesign and its effect on product availability of both product versions to the distribution channel. Among others, we explore how the product architecture and competition affects the technology choice of manufacturers facing such regulatory changes.

■ MA40

H-Sapphire H, Fourth Floor

Financial Optimization and Applications

Sponsor: Financial Services
Sponsored Session

Chair: Kumar Muthuraman, University Of Texas, B6500, 1 University Sta, 78712, United States of America, kumar@mail.utexas.edu

1 - The Effect of Managerial Ability and Commitment on Mutual Fund Allocations
Stathis Tompaidis, Associate Professor, University of Texas at Austin, McCombs School of Business, IROM Department, Austin, TX, 78712, United States of America, Stathis.Tompaidis@mccombs.utexas.edu, Ti Zhou, Ron Kaniel

In a model where mutual fund managers have the ability to generate excess returns we contrast the fund allocations chosen by a manager that invests her personal wealth in a private account to that of a manager that is either forced to commit her wealth to the fund or a manager who is not allowed to hold risky assets held by the fund privately. We show that a fund managed by a manager with higher ability does not necessarily achieve higher expected returns but achieves lower return volatility.

2 - Hydro Scheduling Powered by Derivatives
Jussi Keppo, University of Michigan, 1205 Beal Avenue, Ann Arbor, United States of America, keppo@umich.edu, Stein-Erik Fleten

Using data from thirteen Norwegian hydropower plants, we find that electricity derivative prices affect significantly the scheduling decisions. Hence, consistent with recommendations by several theoretical Operations Management studies, financial market information is used in the everyday production planning practice. Further, since our empirical model explains about 88% of the realized variation in the power plant scheduling, the model can be used to simplify the scheduling in practice.

3 - Equity Default Swaps under the Jump to Default Extended Constant Elasticity of Variance (JDCEV)
Rafael Mendoza-Arriaga, Assitant Professor, The University of Texas at Austin, Information, Risk, & Operations Manageme, CBA 5.202, B6500. 1 University Station, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu, Vadim Linetsky

An Equity Default Swap (EDS) provides protection in case of default and in case of a large drop in the stock price of the reference firm. The credit event of an EDS is better defined and provides higher spreads than a CDS. We price the EDS as a contingent claim written on a defaultable stock using the JDCEV process, where default occurs either by diffusion or by a jump to default. We solve the first passage time problem to compute the EDS spreads and compare them to the equivalent CDS spreads.

4 - Pricing Discretely Monitored Lookback Options in Levy Process Models
Liming Feng, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@uiuc.edu, Vadim Linetsky

We present a method based on the Hilbert transform for the computation of exponential moments of the discrete extremum of a Levy process, and valuation of discrete lookback options in Levy models. When implemented in the Fourier space, our method demonstrates exponentially converging approximation errors.

■ MA41

H-Sapphire L, Fourth Floor

JFIG Research Session I

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Yasemin Merzifonluoglu, Virginia Tech, 250 Durham Hall (0118), Blackburg, VA, 24081, yasemin@vt.edu

1 - Humanitarian Logistics - An Overview I
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu

Humanitarian logistics encompasses a broad range of activities related to preparing, Humanitarian logistics encompasses a broad range of activities related to preparing, responding, and recovering from natural and man-made disasters as well as ongoing humanitarian crises due to war, famine, and infectious diseases. These activities involve the participation of non-governmental organizations (NGOs, e.g., World Food Programme, Red Cross, CARE, World Vision), governments (local, federal), industry, and the military. Disaster relief aid is typically provided on an urgent basis through governments and global aid agencies. Unfortunately the global catastrophes highlighted the difficulties organizations have in planning for and responding to the events including lack of warning systems for the Tsunami, difficulty in reaching earthquake victims because of damaged infrastructure or government policies, and poor response for Katrina victims. These events also highlighted the importance of collaboration and coordination across agencies. According to a Fritz Institute survey, during the tsunami 44% of agencies did not work with others when planning their activities, often chasing the same products. Many of these inefficiencies, which cost lives, could have been avoided with advance planning and capacity building, effective management of response activities, and collaboration and coordination across agencies. We give an overview of the characteristics of humanitarian supply chains and discuss several projects we have conducted in the area with partner organizations.

2 - Humanitarian Logistics - An Overview II
Julie Swann, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States of America julie.swann@isye.gatech.edu

■ MA43

H-Room 400, Fourth Floor

Pricing and Equilibria in Supply Chains

Cluster: Supply Chain Models
Invited Session

Chair: Mahesh Nagarajan, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, mahesh.nagarajan@sauder.ubc.ca

1 - Computing Pure Nash Equilibria in Games with Piecewise Linear Utilities

Christopher Ryan, PhD Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, chris.ryan@sauder.ubc.ca, Albert Xin Jiang, Maurice Queyranne, Matthias Koeppe, Kevin Leyton-Brown

We explore computing pure Nash equilibria for two classes of non-cooperative games with piecewise linear utilities. Using recent results from the algorithmic study of short rational generating functions for encoding sets of integer points, we present efficient algorithms (taking some parameters to be fixed) for deciding the existence of pure Nash equilibria in these games, and as well as other related computations.

2 - Benefits of Decentralization When Customers are Strategic

Gavin Yang, PhD Student, Sauder School of Business, UBC, Vancouver, BC, V6T 1Z2, Canada, gavin.yang@sauder.ubc.ca

We consider a dynamic two-period model of one manufacturer who sells a hi-tech product through retailers, who engage in Cournot competition. With strategic customers, we find that a decentralized channel may have higher profit than a centralized channel with dynamic wholesale price contracts. We find that in addition to the double marginalizationeffect, both downstream retailer competition and customer and firm discounting are also driving factors of the higher decentralized channel profit.

3 - Transshipments of Inventories: Dual Allocations vs. Transshipment Prices

Xiao Huang, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, xiao.huang.2009@marshall.usc.edu, Greys Sosic

We study a newsvendor game in which retailers transship leftover inventories after meeting their local demands. We compare two methods for distribution of residual profit - transshipment prices (TP) and dual allocations (DA). We study the conditions for the existence of the NE under DA, compare efficiency of TP and DA, and develop heuristics for TP when n>2. Our results suggest that the difference in profits is not significant when n=2, and that DA is preferred among more asymmetric retailers.

4 - Joint Pricing and Inventory Control: Sufficient Condition of Quasi-concavity

Zhan Zhang, PhD Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, zhan.zhang@sauder.ubc.ca, Hong Chen

We study a periodic-review, discounted-expected-profit maximization problem for a retailer who faces price-sensitive random demand over a finite horizon. Any unsatisfied demand is backordered. The inventory cost is convex (or quasi-convex). We show that a base stock list price (or base stock list price-type) policy is optimal for additive demand model, under mild sufficient conditions of demand distribution and quasi-concave expected revenue.

■ MA44

H-Room 402, Fourth Floor

Service Systems: Theory and Application

Sponsor: Service Science
Sponsored Session

Chair: Robin Qiu, Associate Professor, Penn State, 30 E Swedesford Road, Malvern, United States of America, robinqiu@psu.edu

Co-Chair: Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu

1 - Application of Structural Equation Models and Principal Component Analysis for Improving an Engineer

Michael Piovoso, Professor, Penn State University, 30 E Swedesford Road, Malvern, PA, 19355, United States of America, mjp5@psu.edu, Robin Qiu

Currently enrolled students were asked to complete a questionnaire to provide data to help us analyze and improve the program. The information was analyzed using Principal Component Analysis (PCA) to guide a Structural Equation Model (SEM). The results of that analysis will be presented.

2 - Semi-supervised Methodology for Accurate Categorization and Labeling of Services Engagements

Aleksandra Mojsilovic, IBM, 1195 West Fremont Avenue, Sunnyvale, CA, 94087, United States of America aleksand@us.ibm.com, Moninder Singh, Jianying Hu

Due to dynamic business environments and changing customer needs service portfolios are frequently redefined, limiting the ability to apply analytics and project management tools to track project success along the categories aligned with service portfolio. We describe a semi-supervised clustering methodology to perform new project categorization every time the solution taxonomy changes and discuss its application in a web-based decision support system.

3 - Extreme Customer Service: An Approach to Staying Competitive

Jingjing Zhou, Nanjing Golden Eagle Summit Hotel, 1 Zhujiang Road, Nanjing, JS, 210008, China, njartjingjing@yahoo.com.cn

There is a lack of practical models to help hotels transform to meet the changing needs in today's dynamic market. This talk shows our exploration of an innovative modeling methodology focusing on enabling better understanding of how hotels perform quantitatively and qualitatively. The model is able to pinpoint the challenges during daily operations and then identify optimal countermeasures and priorities in transforming the operations to remain in the outperform class as time goes.

4 - Service Composition Based on Networks and Mathematical Programming

Liying Cui, PhD Candidate, Penn State University, 121 EE East, University Park, PA, 16802, United States of America, luc5@psu.edu, Soundar Kumara, Tao Yao

Service composition is to fuse the distributed business processes together to form compound services in a timely and accurate manner. A matrix based graph analysis method is used in the web service network analysis to detect the correlations between services and parameters. Multi-criteria programming model is used to make optimal plans for queries.

■ MA45

H-Room 410, Fouth Floor

Empirical Research in New Product Development

Cluster: New Product Development
Invited Session

Chair: Kamalini Ramdas, Professor, London Business School, kramdas@london.edu

1 - Technological Spillovers and the Agglomeration of the Semiconductor Industry in Silicon Valley

Francisco Veloso, fveloso@cmu.edu, Steven Klepper, Jon Kowalski

We investigate the microfoundations of technological spillovers in clusters. When these result from information exchange or employee mobility, existing firms in clusters should move to the technological frontier faster. But when the conduit is spinoffs, firms in clusters are likely to start at the technological frontier. Using data on virtually every firm that entered the semiconductor industry and their entire set of products, we find that knowledge diffused mostly through spinoffs.

2 - Creative Problem Solving: A Tournament Approach

Karan Girotra, Assistant Professor, INSEAD, Boulevard De Constance, Fontainebleau, France, karan.girotra@insead.edu, Christian Terwiesch, Karl Ulrich

Creative problem solving often entails an iterative process of generation of multiple solutions to a problem followed by the selection and refinement of the top few. We examine the effectiveness of alternate solution generation, selection and refinement processes. We propose metrics for evaluation of each of the sub-processes and suggest strategies to improve the outcome of the Creative Problem Solving Exercise.

■ MA46

H-Room 411, Fourth Floor

Technology and Innovation

Sponsor: Technology Management
Sponsored Session

Chair: Janice Carrillo, Associate Professor, University of Florida, P.O. Box 1171769, Gainesville, FL, 32611-7169, United States of America, janice.carrillo@cba.ufl.edu

1 - The Market Value of Supply Chain Flexibility: Theory and Evidence From the Clean Energy Industry

Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu, Jane Davies

Nexus of competition is said to be shifting from individual firms to supply chains. We study flexibility, integration, assets and technology constructs that are

reflected in the stock market valuation and then calculate associated supply chain effects. We offer and test hypotheses on the synergy between these constructs in the context of 42 solar photovoltaic supply chains. Results indicate that integration and assets are significantly associated with the valuation of the supply chain.

2 - Globalization, Offshoring, and the Location of Innovation: A Case Study of Rare Earth Technology

Brian Fifarek, Engineering Supervisor, Eaton Corporation, 4201 N 27th St., Milwaukee, WI, 53216, United States of America, BrianFifarek@Eaton.com

We analyze the impact of the movement of rare earth materials production from US to China on US rare earth innovation activities. We show that this movement causes some innovation activities to move away while others remain. We suggest that this relocation of innovation is conditioned by the nature of innovation processes and the role of knowledge spillovers among value chain actors. Using patents and industry observations, we use regression and modeling techniques to test this relationship.

3 - The Emergence of Architecture in Modular Systems: Coordination Across Boundaries at ATLAS, CERN

Philipp Tuertscher, Assistant Professor, WU Vienna University of Economics and Business, Entrepreneurship and Innovation, Nordbergstrasse 15, Vienna, 1090, Austria, Philipp.Tuertscher@wu-wien.ac.at, Markus Nordberg, Raghu Garud

Our study of the development of a complex technological system suggests that the emergence of technological architecture is characterized by an ongoing process of negotiations across diverse actors who have to justify and explain their design rationales. Such a process results in what we call interlaced knowledge, making it possible for actors to generate a deeper systemic understanding of the various components, anticipate latent interdependencies and coordinate even as the design emerges.

4 - Explaining Structural Ambidexterity in High Technology Organizations: A Multilevel Perspective

Aravind Chandrasekaran, The Ohio State University, Management Sciences Department, Fisher College of Business, Columbus, OH, 43210, United States of America, chandrasekaran.24@osu.edu, Roger Schroeder, Kevin Linderman

Prior studies have emphasized the importance of structural ambidexterity. Yet, our understanding about this capability is still limited. This research delineates structural ambidexterity into two different contexts: macro and micro organizational contexts. Using multilevel data collected from 34 high technology divisions and 110 innovation and improvement projects, we examine the effects of both these contexts on project performance. Theoretical and practical Implications are discussed.

■ MA47

H-Room 412, Fourth Floor

Tutorial: Interfaces of OM and Economics

Cluster: Tutorials
Invited Session

Chair: Martin Lariviere, Kellogg School of Management, Northwestern University, Evanston, IL, 60091, United States of America, m-lariviere@northwestern.edu

1 - Interfaces of OM and Economics

Martin Lariviere, Kellogg School of Management, Northwestern University, Evanston, IL, 60091, United States of America, m-lariviere@northwestern.edu

This tutorial will examine the research interface between Operations Management and Economics. We will discuss the evolution of this research, where we stand now, and what questions remain open. Special attention will be paid to applications in supply chain contracting, principal-agent problems, and the role of strategic customers.

■ MA48

H-Sapphire Green Room, Fourth

History of OR/MS

Contributed Session

Chair: Orhan Guvenen, Professor, Bilkent Univesirty, Ankara, Turkey, gorhan@bilkent.edu.tr

1 - Concerning the Evolution of the Jobcentric Network Schedule

Chris Smith, Adjunct Professor, University of Maryland, 4112 Everett Street, Kensington, 20895, United States of America, ltccsmith@yahoo.com

The evolution of network scheduling topologies; from the early applications of the U. S. Navy Special Projects Office, U. S. Navy Bureau of Yards and Docks, du Pont and Sperry Rand Corporations, through contemporaneous versions of the Precedence Diagramming Method, is presented. The shift to 'jobcentric' topologies in the late 1960s and 1970s is highlighted as is the recent emergence of CPM as a manipulative device employed within questionable financial recovery schemes.

2 - Transdisciplinarity in Decision Sciences: A Discourse on Polymath-Renaissance Man Methodology

Orhan Guvenen, Professor, Bilkent Univesirty, Ankara, Turkey, gorhan@bilkent.edu.tr, Murat Hakan Ozturk

In the recent century, through the developments of analytical methods in Decision Sciences, reductive subset analysis has emerged as a main challenge in the analysis of socio-economic phenomena. In this study, we are going to explore the integrated fallicies in the theory of decision sciences ranging from information distortion to rationality concept.

■ MA49

H-Room 300, Third Floor

Workforce Planning in Professional Service Organizations

Cluster: Workforce Engineering and Management
Invited Session

Chair: Jennifer Ryan, Associate Professor, Decision Sciences and Engineering Systems, RPI, 110 8th St Ctr for Industrial Innovation, Suite 5015, Troy, NY, 12180, United States of America, ryanj6@rpi.edu

1 - Modeling the Workforce Planning Process in Service Operations

Vincent Hargaden, PhD Student, UCD Michael Smurfit Graduate Business School, Centre for Doctoral Research, Blackrock, Dublin, Ireland, vincent.hargaden@ucd.ie, Jennifer Ryan

We develop a mixed integer programming model that enables professional service firms to optimise the allocation of their employees to meet customer project requirements in a dynamic operating environment. We will present results from the model based on data from a number of professional service firms of varying size to illustrate the issues facing such firms as they attempt to optimally match skilled workers to customer demand.

2 - Workforce Planning for Services with Short Lives

Ruwen Qin, Assistant Professor, Missouri S&T, Engineering Management & Systems Enginee, Rolla, MO, 65409, United States of America, qinr@mst.edu, Haiyuan Wang

We study the workforce planning for services with short lives. The average service time is long at the beginning of a service's life, and it declines progressively as served requests accumulate. This process of learning is manageable through workforce planning and is influenced by the demand distribution over the service's life. Optimal control is used in this study to minimize the total of lifecycle costs.

3 - The Effect of Department and Organizational Structure on Knowledge Transfer

Tonya Boone, Associate Professor, College of William & Mary, Operations & Information Technology, Mason School of Business, Williamsburg, VA, United States of America, Tonya.Boone@mason.wm.edu

We consider the factors associated with organizational knowledge transfer in a professional service organization with multiple departments. Earlier research has demonstrated the likelihood of asymmetric knowledge flows among departments. This talk explores the potential factors underlying the asymmetries, and develops suggestions for improving overall knowledge transfer.

■ MA50

H-Room 302, Third Floor

The Wide World of Sports

Sponsor: SpORts
Sponsored Session

Chair: Joel Oberstone, Professor, University of San Francisco, School of Business & Management, 2130 Fulton Street, San Francisco, CA, 94117, United States of America, qba.teechur@gmail.com

Co-Chair: Keith Willoughby, Associate Professor, University of Saskatchewan, Dept of Finance and Management Science, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca

1 - Searching for Momentum in the NFL

Michael Fry, Associate Professor, University of Cincinnati, 532 Lindner Hall, Cincinnati, OH, 45221, United States of America, mike.fry@uc.edu, F. Alan Shukairy

Momentum has been described as "the most important thing in football, even if I'm not sure what exactly it is" by sports writer Frank Deford. Here we seek to identify the impact of momentum in the National Football League. We examine so-called "momentum-changing" events in a football game (e.g., fourth down conversions) and statistically analyze their impact on team performance as measured by subsequent yards gained, expected points scored and other measures.

2 - Locally Optimized Crossover for the Traveling Umpire Problem
Michael Trick, Professor of Operations Research, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15232, United States of America, trick@cmu.edu, Hakan Yildiz

We present a genetic algorithm (GA) to solve the Traveling Umpire Problem, which is a recently introduced sports scheduling problem that is based on the most important features of the real Major League Baseball umpire scheduling problem. In our GA, contrary to the traditional way of randomly obtaining new solutions from parent solutions, we obtain partially optimized solutions with a locally optimized crossover operator. Improved results over other methods are presented on benchmark instances.

3 - Scheduling Games in the Canadian Football League
Keith Willoughby, Associate Professor, University of Saskatchewan, Dept of Finance and Management Science, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca, Kent Kostuk, Josh Oubadia

The 8-team Canadian Football League features an 18-game regular season played between late June and early November. Currently, the regular season schedule is manually created. We report on the development of a mathematical model to efficiently schedule games. Our model incorporates various objective functions (e.g. maximizing intra-divisional games in the season's "home stretch"), thereby providing league officials with another perspective on schedule development.

4 - English Premier League Goalkeepers: Using the Opta Index to Separate the Best From the Rest
Joel Oberstone, Professor, University of San Francisco, School of Business & Management, 2130 Fulton Street, San Francisco, CA, 94117, United States of America, qba.teechur@gmail.com

The Opta Index is a prestigious, proprietary method used to assess English Premier League (EPL) football players. The Index grades a player on a specific, weighted array of game actions. This paper proposes an alternative to using the Opta Index as the primary indication of player worth. A retrodictive linear regression model for determining the statistical significance of the game actions for the goalkeeper position is presented using Opta Index data from the 2007-2008 EPL Season.

■ MA51

H-Room 303, Third Floor

Scheduling

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Nedialko Dimitrov, The University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, ned.dimitrov@gmail.com

1 - Sequencing of Events with Group Availability and Precedence Constraints
Ada Barlatt, Assistant Professor, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, abarlatt@uwaterloo.ca, Arleigh Waring

Motivated in part by interview scheduling, we present an algorithm that efficiently sequences events subject to availability and precedence constraints. Each event has predetermined duration and attendee requirements. Our algorithm integrates individual schedules to sequence events according to the availability of attendees. We discuss how our approach extends to other sequencing problems.

2 - Preventive Maintenance Models for a System of Stochastic and Structurally Dependent Equipments
Inderjeet Singh, The University of Texas at Austin, Operations Research / Industrial Engg., 1 University Station C2200, Austin, TX, 78712, United States of America, inderjeet@mail.utexas.edu, Elmira Popova, Ernie Kee

We optimize preventive maintenance schedule for a repairable system of multiple equipments when failure and structural dependencies exist between the equipments. The equipments of interest have increasing rate of occurrence of failures and are minimally repaired upon failure. All the equipments undergo preventive maintenance at the end of a finite planning horizon and the budget for the preventive maintenance is limited. The objective is to minimize the expected total corrective maintenance cost

3 - Hospital Patient Flow Management through Admission Scheduling and Control
Jonathan Helm, University of Michigan, 1205 Beal Ave, Ann Arbor, United States of America, jhelm@umich.edu, Mark Van Oyen

Hospital care services are frequently subject to significant and unnecessary detrimental fluctuations in inpatient census and associated workload. One of the primary controllable drivers in this census variability is the way in which patients are admitted to the hospital for an inpatient stay. This talk focuses on analysis and optimization of two levers for controlling patient flow: 1) elective admission scheduling, 2) dynamic census adjustment with the goal of reducing census variability.

■ MA52

H-Room 304, Third Floor

Pricing Strategy and Distribution Channels

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Dennis Yu, Clarkson University, School of Business, Potsdam, NY, 13699, United States of America, dyu@clarkson.edu

1 - Ordering and Pricing a Fashion Product to Minimize Regret
Scott Webster, Professor, Syracuse University, 721 University Av, Syracuse, NY, 13244, United States of America, stwebste@syr.edu, Charles Wang, Sidong Zhang

We consider the problem of ordering and pricing a fashion product. Product that remains after the season will be marked down or sold through a liquidator. The retailer is able to accurately estimate lower and upper limits on valuation. The objective is to minimize the maximum regret. We derive expressions for optimal solutions to single-product problems and we apply these results to solve multi-product problems with budget constraints.

2 - The Effect of Distribution of Free Product in a Dual Channel
John Zhijiang Ni, Ph.D Candidate, Kelley School of Business, Indiana University, 1309 East 10th Street, Bloomington, IN, 47401, United States of America, jzni@indiana.edu, Hans Sebastian Heese, Xinxin Hu

Besides distributing a high-quality software product through a traditional bricks-and-mortar retail channel, software and game developers often also offer a free lower-quality version of the product on-line, hoping that customers later pay for a product upgrade. We analyze the effects of such a dual channel strategy on profitability and product cannibalization.

3 - Direct-Markerting Optimization for Public Broadcasting Stations
Elizabeth Durango-Cohen, Illinois Institute of Technology, 565 W. Adams Street, Chicago, United States of America, durango-cohen@iit.edu, Pablo Durango-Cohen

Our research focuses on the development of direct-marketing strategies for broadcasting stations. We develop a framework that: 1. Identifies segments within the station's listening community; 2. Categorizes marketing actions toward each segment; and 3. Determines the optimal policy to maximize long-run, expected net revenue raised. To solve the problem, we develop an instance of the EM Algorithm to cluster the population into homogeneous segments, and maximize revenues for each segment.

4 - Capacity Investment Strategy with a Salvage Channel
Dennis Yu, Clarkson University, School of Business, Potsdam, NY, 13699, United States of America, dyu@clarkson.edu, Chester Xiang

We study a manufacturer's production capacity and pricing decisions when it is possible to sell surplus inventory through a salvage distribution channel which can be either integrated or independent channel. The impacts of market demand uncertainties on the manufacturer's optimal capacity, retail price decisions, and expected profit are investigated under different channel structures.

■ MA53

H-Room 305, Third Floor

Exact and Heuristic Algorithms for Mixed-Integer Nonlinear Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Pietro Belotti, Lehigh University, Dept of Industrial & Systems Engineering, 200 W Packer Ave, Bethlehem, PA, 18015, United States of America, belotti@lehigh.edu

1 - Convex Envelopes for Bounded Multilinear Function
Mahdi Namazifar, University of Wisconsin, 1513 University Ave, Madison, WI, United States of America, namazifar@wisc.edu, Pietro Belotti, Andrew Miller

We study linear envelopes for the bounded single term multilinear functions. Tight convex relaxations of such functions are sought in order to obtain a lower bound of a non-linear, nonconvex problem whose feasible solutions are defined by multilinear functions. This is motivated by the fact that many exact solvers for nonconvex problems use polyhedral relaxations so as to compute a lower bound via Linear Programming solvers.

2 - Cardinality Bounded Convex Programs

Daniel Bienstock, Columbia University, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu

We present bounding techniques based on the S-lemma and on constrained eigenvalue optimization, for problems involving the optimization of a convex function (in particular, a convex quadratic) subject to non-standard nonconvex constraints (in particular, a bound on the cardinality of the support).

3 - Convexification of Nonconvex Functions and Polyhedral Envelopes

Chuanhui Xiong, Purdue University, Krannert School of Management, West Lafayette, United States of America, cxiong@purdue.edu, Mohit Tawarmalani, Jean-Philippe Richard

In factorable programming, a new variable is often introduced to relax a function that is a composition of a convex and a linear function. We improve the traditional relaxation for such a substitution by developing the convex and concave envelopes of such a function over a hypercube. We then extend the result to polynomial functions of the introduced variables. We apply the results to develop envelopes for certain fractional functions that appear in consistent biclustering problems.

■ MA54

H-Room 306A, Third Floor

Optimization for Online Advertisement I

Sponsor: Optimization/Networks
Sponsored Session

Chair: Vahab S. Mirrokni, Research Scientist, Google Research, 76 9th Ave, 4th floor, New York, NY, 11206, United States of America, mirrokni@gmail.com

1 - Online Story Scheduling in Web Advertising

Hamid Nazerzadeh, Post-doc Researcher, Microsoft Research, One Memorial Dr, Cambridge, MA, United States of America, hamidnz@microsoft.com, Anirban Dasgupt, Arpita Ghosh, Prabhakar Raghavan

We study an online job scheduling problem motivated by storyboarding in web advertising, where an advertiser derives value from uninterrupted sequential access to a user surfing the web. We design online competitive algorithms for this problem.

2 - Incentive Compatible Budget Elicitation in Multi-unit Auctions

Sayan Bhattacharya, Graduate Student, Duke University, Box 90129, Durham, NC, 27708, United States of America, bsayan@cs.duke.edu, Vincent Conitzer, Lirong Xia, Kamesh Munagala

We consider the problem of designing incentive compatible auctions for multiple units of a good, when bidders have private valuations and private budget constraints. When bidders are prevented from over-reporting their budget constraints by randomizing the prices charged, we show the existence of a truthful mechanism that is not only Pareto-optimal but also revenue-optimal. In sharp contrast, it is already known that there is no deterministic mechanism with these properties.

3 - Fair Allocation with Succinct Representation

Saeed Alaei, University of Maryland, AV Williams Bldg, UMD-CP, College Park, MD, 20742, United States of America, saeed.a@gmail.com

we consider the problem of fair allocation in a bipartite supply-demand setting. We capture measure the fairness by a convex penalty function. While this admits a convex programming solution, we strive for more efficient algorithms. For the case of L_1 penalty functions we obtain a simple combinatorial algorithm based on min-cost flow and show how to precompute a linear amount of information such that the allocation along any edge can be approximated in constant time.

4 - Optimizing Budget Constrained Spend in Search Advertising

Aranyak Mehta, Google Research, Mountain View, United States of America, aranyak.mehta@gmail.com, Ramakrishnan Srikant, Anshul Kothari

We study the allocation of budget constrained spend in search engine ad auctions in order to achieve different objectives, such as maximizing the quality of impressions seen by users, or maximizing the ROI of advertisers. We show how to adapt these algorithms to a practical online setting where we need to decide whether to show an ad with a sub-second response time.

■ MA55

H-Room 306B, Third Floor

Sketching in Large Computations

Sponsor: Optimization/Networks
Sponsored Session

Chair: Rina Panigrahy, Researcher, Microsoft Research, 1065 La Avenida, Sunnyvale, CA, 94043, United States of America, rina@microsoft.com

1 - Annotations in Data Streams: Quis Adumbrabit Ipsos Adumbrantes

Andrew McGregor, University of Massachusetts, 140 Governors Drive, Amherst, 01002, United States of America, amcgregor@gmail.com, Amit Chakrabarti, Graham Cormode

Motivated by work in the database community on outsourcing stream processing, we ask whether the memory required by a stream algorithm can be reduced by enlisting a more powerful 'helper' who can annotate the stream as it is read. We do not wish to blindly trust the helper, so we require that the algorithm be convinced of having computed a correct answer. We present optimal algorithms that achieve a nontrivial tradeoff between the amount of annotation used and the memory required to verify it.

2 - Route Planning in Time-Dependent Transportation Networks

Daniel Delling, Microsoft Research SVC, 1065 La Avenida, Mountain View, CA, 94043, United States of America, delling@iti.uni-karlsruhe.de

In this talk, I present an efficient route planning algorithm that works in time-dependent transportation networks. By combining and augmenting basic ingredients from time-independent route planning, we obtain a powerful route planning algorithm, called SHARC. An experimental evaluation shows the feasibility of our approach: The computation of quickest paths in time-dependent continental-sized transportation networks, both of roads and of railways, is a matter of milliseconds.

3 - Hashing for High Dimensional Search

Rina Panigrahy, Researcher, Microsoft Research, 1065 La Avenida, Sunnyvale, CA, 94043, United States of America, rina@microsoft.com

Similarity search in complex objects such as images, documents is often modeled as nearest neighbor search in a high dimensional metric space. This problem of building a data-structure to support nearest neighbor queries is believed to suffer from the 'curse of dimensionality'. We will see some of the best known upper bounds for this problem based on a technique known as Locality Sensitive Hashing. We will also provide an intuition as to why the problem may be fundamentally difficult.

■ MA56

H-Room 307, Third Floor

Portfolio Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Victor DeMiguel, Associate Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, avmiguel@london.edu

1 - A Pathwise Algorithm for Covariance Selection

Alexandre d'Aspremont, Princeton University, Dept of Operations Res & Fin Eng, Princeton University, Princeton, NJ, 08544, United States of America, aspremon@princeton.edu, Vijay Krishnamurthy

Covariance selection seeks to estimate a covariance matrix by maximum likelihood while restricting the number of nonzero inverse covariance matrix coefficients. A single penalty parameter usually controls the tradeoff between log likelihood and sparsity in the inverse matrix. We describe an efficient algorithm for computing a full regularization path of solutions to this problem.

2 - Efficient Estimation of Large Dynamic Multivariate Volatility Models for Portfolio Optimization

Francisco J. Nogales, Associate Professor, Universidad Carlos III de Madrid, Department of Statistics, Madrid, Spain, FcoJavier.Nogales@uc3m.es

In large portfolio selection problems, the estimation of dynamic multivariate volatility models (maximization of a nonlinear likelihood function subject to a constraint ensuring the positiveness of all the conditional covariance matrices) becomes unstable. This is mainly due to the need of inverting all the conditional matrices at each iteration. We propose new multivariate volatility specifications and compare the resulting portfolio performance with that of several recent proposals.

3 - Exploiting Asset Return Predictability for Portfolio Selection
Victor DeMiguel, Associate Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, avmiguel@london.edu, Francisco J. Nogales

There is extensive evidence in the Finance literature about the predictability of asset returns. We explore the use of parametric and nonparametric statistical methods to exploit asset return predictability for portfolio selection, and show that substantial certainty equivalent gains can be achieved.

■ MA57

H-Room 308, Third Floor

Decision Making Strategies in Consumer-Based Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: George Konstantinow, OR-Analysis.com, 142 La Vista Grande, Santa Barbara, CA, 93103, United States of America, george.konstantinow@or-analysis.com

1 - Accuracy and Effectiveness of Outcomes From Evidence-based and Value-based Medicine
John Denning, Principal, WholesaleChange, Inc., P.O. Box 3622, Walnut Creek, CA, 94598, United States of America, j.denning@wholesalechange.com, Anwar Parvez, Robert Morris

Evidence-based medicine is gaining increasingly wider acceptance among medical practitioners. We present a corresponding value-based model of medical and financial decision making that patients and providers may share to assess health care and wellness options. Value-based analytics provide a valuable means for selecting provider service options, including consumer preferences, and judging treatment effectiveness in health care delivery

2 - Rules-Based Assessment of Medical Treatments Based on Health vs. Disease Management
Anwar Parvez, Principal, Wholesale Change, Inc., P.O. Box 3622, Walnut Creek, CA, 94598, United States of America, a.parvez@wholesalechange.com, John Denning, Robert Morris

Medical treatments and their comparative effectiveness vary according to differing cost- and value-based concerns among medical practitioners and consumers. We present a rules engine to assess medical and financial decision paths that patients and providers may use in selecting alternatives among various health care and wellness schemes. Rules-based assessments of treatment cost and effectiveness provide a valuable means for selecting service delivery options in health care economics.

3 - Game Theory and Healthcare - Models for Cooperation and Competition in Consumer-Based Medicine
George Konstantinow, OR-Analysis.com, 142 La Vista Grande, Santa Barbara, CA, 93103, United States of America, george.konstantinow@or-analysis.com

Health care service models reflect high levels of consumer choice in maintaining health and managing disease. We consider strategic decisions that patients, providers, and payers make in selecting treatment paths among various options. We present games that describe competitive and cooperative stakeholder interactions based on provider value and consumer utility. Models of games in health care economics show how healthcare networks behave and how service delivery can be optimized.

■ MA58

H-Room 309, Third Floor

Games on Production Capacity Allocation

Cluster: Scheduling
Invited Session

Chair: Zhixin Liu, Assistant Professor, College of Business, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu

1 - Scheduling Coordination, Contract Design, and Competition for Uncertain Third-party Capacity
Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu

Numerous companies resort to subcontracting as a short-term strategy to increase output, especially when they bid for contracts that require production beyond capacity and timely delivery to customers. On the other hand, subcontracting involves inherent risks such as the competition for and the uncertainties associated with the third-party capacity. In this paper, we study scheduling coordination issues that arise in such a setting, and provide contract forms to achieve centralized performance.

2 - Impact of Transshipment on Retailers
Ruixia Shi, University of Richmond, 1 Gateway Road, Richmond, VA, rxs048100@utdallas.edu, Jun Zhang

This paper analyzes the impact of transshipment on retailers' performance. We analytically demonstrate that retailers are worse off in general when the manufacturer can adjust the wholesale price. We further characterize the conditions under which retailers benefit from transshipment.

3 - Alliance Formation Among Perfectly Complementary Suppliers in a Price-sensitive Assembly System
Shuya Yin, Assistant Professor, University of California-Irvine, Paul Merage School of Business, Irvine, CA, 92697, syin@exchange.uci.edu

Independent parties who produce perfectly complementary components may form alliances to better coordinate their pricing decisions when they sell their products to downstream buyers. This paper studies how market demand conditions drive coalition formation among component suppliers in an assembly system. We show that the size of coalitions formed in equilibrium depends crucially on the demand function, and we use the concept of pass-through rate to interpret these differences.

4 - Batching and Due Date Coordination in Supply Chains
Rui Zhang, McMaster University, 1280 Main Street West, Hamilton, Canada, zhangr6@mcmaster.ca, George Steiner

We study a scheduling problem with delivery costs and due date assignment. We first show it is strongly NP-hardness. Then we provide a pseudo-polynomial algorithm and an FPTAS for the case when due-date-assignment costs are equal. Finally, we propose a polynomial algorithm for the case with uniform due-date-assignment cost and uniform tardiness penalty.

■ MA59

H-Room 310, Third Floor

Tutorial: Geometric Programming

Cluster: Tutorials
Invited Session

Chair: Thomas Jefferson, Doctor, Optimal Duality Institute, P.O. Box 4102, Ormond Beach, FL, 32175-4102, United States of America, trjefferson@hotmail.com

1 - Geometric Programming
Thomas Jefferson, Doctor, Optimal Duality Institute, P.O. Box 4102, Ormond Beach, FL, 32175-4102, United States of America, trjefferson@hotmail.com, Carlton Scott

BEGINNING: Discovery by Zener of a novel way to solve engineering problems and provide closed-form sensitivity analysis. Theory of Geometric Programming developed with Duffin & Peterson. EXTENSIONS: Signomial Programming (Wilde and Passy). Generalized Geometric Programming (Peterson). Applications in engineering, science and business. BACK TO THE FUTURE: Revisit the original method of Legendre Duality to unify theory and solve non-convex problems in economics and business.

■ MA60

H-Room 311, Third Floor

New Advances in Interior-Point Methods: Implementation

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Yuriy Zinchenko, University of Calgary, 2500 University Drive NW, MS446, Calgary, AB, T2N 1N4, Canada, yzinchen@optserv.cas.mcmaster.ca

1 - Semidefinite Programming in Mathematica
Mauricio de Oliveira, MAE/UCSD, 9500 Gilman Dr., Mail Code 0411, La Jolla, CA, 92093, United States of America, mauricio@ucsd.edu

We describe an implementation of an interior-point algorithm for semidefinite programming (SDP) in Mathematica. We take advantage of Mathematica's symbolic capability to develop some unique features. For instance, on small problems with integer or rational data, we allow the use of exact arithmetic to construct a sequence of rational iterates. On large structured problems we use symbolic manipulation to assist the computation of search directions.

2 - Novel Code Optimization Techniques for GPUs
Vasily Volkov, UC Berkeley, 447 Soda Hall, Berkeley, CA, 94720, United States of America, volkov@cs.berkeley.edu

New programming techniques are required to benefit more from the rapid evolution of GPUs. I suggest taking advantage of the fast and uniquely large GPU register files by keeping there the working set and using shared memory for

communication. Also, I argue that running fewer concurrent threads but doing more parallel work per thread may often be a better way of hiding memory latency. Finally, I point to the difficulties in fine-grain global synchronization and trends towards resolving them.

3 - Solving Large-scale Dense SOCP on Heterogeneous Computing Platform

Yuriy Zinchenko, University of Calgary, yzinchen@ucalgary.ca

To minimize negative impact of uncertainties in optimal radiotherapy planning for cancer treatment, a convex robust counterpart of a conventional model has been proposed. The robust model is a large-scale dense SOCP. However, presently, such an approach is clinically infeasible due to excessive computational demands associated with solving the resulting problem. We investigate the use of heterogeneous platforms, namely GP-GPU, to speed up linear algebra operations required by IPM solver.

■ MA61

H-Room 312, Third Floor

New Directions in Location Modeling

Sponsor: Location Analysis
Sponsored Session

Chair: Dmitry Krass, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca

1 - Placement of Warehouse Cross-aisles

Paul Berglund, SUNY University at Buffalo, 786 West Ferry Street, Buffalo, NY, 14222, United States of America, berglund@buffalo.edu, Rajan Batta

This paper investigates the optimal placement of cross-aisles in an order-consolidation warehouse as a consequence of the probability density function of order pick locations. An analytical solution procedure is developed for the optimal placement of a single cross-aisle given an arbitrary probability density of pick locations, which is then generalized to a method for multiple cross-aisles. The result obtained is then checked by a simulation study.

2 - On the Benefits of Risk Pooling in Inventory Management

M. Mahdi Tajbakhsh, Post-doctoral fellow, Rotman School of Management, University of Toronto, 105 St. George st., Toronto, ON, M5S3E6, Canada, Mahdi.Tajbakhsh@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

We study risk pooling in a multi-location newsboy framework. Using common demand distributions, we investigate the sensitivity of the risk pooling benefits to the variability of the individual demands and the number of locations under a variety of common demand distributions. We show that as variability increases, an inventory system goes into "effective shutdown" mode; centralized systems are able to delay shutdown longer.

3 - Optimal Location, Pricing and Capacity Planning under Elastic Demand and Uncertainty

Dehui Tong, Doctorla Candidate, Rotman School of Management, University of Toronto, 105 St. George st., Toronto, ON, M5S 3E6, Canada, Dehui.Tong04@Rotman.Utoronto.Ca, Dmitry Krass, Oded Berman

We study a single-facility system where stochastic demand is sensitive to travel distance, congestion (waiting time) and price. Under some conditions, optimal price is independent of location and capacity decisions and optimal locations are nodal. We investigate when these properties hold and when they break down.

4 - Cooperative Coverage

Dmitry Krass, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca, Oded Berman, Zvi Drezner

A new concept of coverage is proposed: each facility emits a "signal" which decays over distance and each demand point receives the total signal emitted by all facilities; the demand point is covered the total signal exceeds a given threshold. Thus facilities cooperate to provide coverage. We show that this framework generalizes the standard concept of coverage and is appropriate in a variety of applications. Optimal and heuristic algorithms are presented for the planar case.

■ MA62

H-Room 313, Third Floor

Micromotives in Operations Management

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Mirko Kremer, Penn State University, 460 Business Building, State College, United States of America, muk22@psu.edu

1 - An Experimental Study on Customer Perceptions and Behavior in Ticket and Physical Queues

Kaan Kuzu, The Pennsylvania State University, Smeal College of Business SC&IS Department, 471B Business Building, University Park, PA, 16802, United States of America, kaankuzu@psu.edu, Susan Xu

We conduct an experimental study to gain insights into customer perceptions of and behavior within the ticket and physical queue environments. In each environment, we learn how customers form their patience before wait and adapt the patience during wait. We also examine the impact of providing different types of information on the service level in the ticket queue.

2 - Overconfidence in the Newsvendor Problem: An Experiment Study

Yufei Ren, Student, University of Texas at Dallas, 800 W. Campbell Road, Richardson, TX, 75080, United States of America, yxr051000@utdallas.edu, Rachel Croson

A number of behavioral factors have been suggested which might cause suboptimal decisions in supply chain and inventory planning problems, including anchoring and insufficient adjustment, bounded rationality and overconfidence. In this experimental study, we disentangle these underlying causes by measuring an individual's level of overconfidence, anchoring and beliefs and comparing these measures with their decisions in a simplified newsvendor setting.

3 - Designing Contracts for Supply Chains with Irrational But Predictable Newsvendors

Ulrich Thonemann, University of Colgone, Albertus Magnus Platz, Cologne, Germany, Ulrich.Thonemann@uni-koeln.de, Michael Becker-Peth, Elena Katok

Typically, it is assumed that sellers optimize the contract parameters under the assumption that the buyers are placing orders that maximize their expected profits, a decision commonly referred to as rational. We conduct a number of experiments and analyze the buyers' order behavior. We demonstrate that the orders quantities of buyers are not expected profit maximizing, but that they can be predicted quite accurately and build on this information to design various contracts.

4 - Human Demand Forecasting in Times of Change

Mirko Kremer, Penn State University, 460 Business Building, State College, United States of America, muk22@psu.edu, Enno Siemsen, Brent Moritz

Previous research documents the inability of human forecasters to distinguish substantive change from random variation, in settings where a well known phenomenon needs to be detected (e.g. when a bull market turns into a bear market). We investigate this behavioral bias in the context demand forecasting, which is more ambiguous (i.e. future demand distributions are not countable and known) and encompasses many small changes (i.e. traffic patterns, consumer tastes, sense of fashion etc.).

■ MA63

H-Room 314, Third Floor

Joint Session OR Bio/HAS/Homeland:OR in Biodefense

Cluster: OR in Biomedicine and Global Health, Health Applications, & Homeland Security
Invited Session

Chair: Eva Lee, Associate Professor and Director, Georgia Institute of Technology, School of Ind & Sys Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

1 - Public Health as a National Security Issue: New Findings

Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

New research indicates that disasters' physical effects, such as acute respiratory distress, precipitate both physical and psychological effects that may take two years or more to present. This implies that we need to reexamine the whole approach we use to assess the effectiveness of post-disaster acute care and to monitor population health as an early indicator of bioattack. We discuss some implications.

2 - Modeling and Simulation and Quick Look Planning Tools for Pandemic Influenza and Infectious Diseases

Robert Brigantic, Operations Research Scientist, Pacific Northwest National Laboratory, 902 Battelle Blvd., Richland, WA, 99352, United States of America, robert.brigantic@pnl.gov, Aimee Taylor, Courtney Corley

We present an overview of modeling and simulation methodologies employed to examine the potential impacts and mitigative measures associated with pandemic influenza and infectious diseases. We also present quick look planning tools in development that can also assist public health officials with planning activities and consequence management associated with a pandemic, such as the recent Swine Flu outbreak of 2009.

3 - Mitigation Strategies in Response to Bioterrorism or Infectious Disease Outbreaks

Eva Lee, Associate Professor and Director, Georgia Institute of Technology, School of Ind & Sys Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

Mitigation strategies for bioterrorism or infectious disease outbreaks require multilevel efforts: treatment of the ill, protection of the worried-well, voluntary home quarantine, social distancing at work, encouragement of telecommuting, strategic isolation of high-risk school children, and potential closing of schools. We contrast the various levels of protection needed for different scenarios of outbreak and provide some recommendations and guidelines. This work is joint with CDC.

■ MA64

H-Room 202A, Second Floor

Communication Instruction in Engineering and Business Schools I

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Judith Norback, Dir. of Workplace and Academic Communication, Georgia Tech, Stewart School of Industrial and Systems, judith.norback@isye.gatech.edu

Co-Chair: Elke Leeds, Assistant Professor, Kennesaw State University, School of Accountancy Coles College of B, 1000 Chastain Road - Bldg. #4 Office - B, Kennesaw, GA, 30144, eleeds@kennesaw.edu

1 - Managerial Communication Redesign in Executive Business Education

Elke Leeds, Assistant Professor, Kennesaw State University, School of Accountancy Coles College of B, 1000 Chastain Road - Bldg. #4 Office - B, Kennesaw, GA, 30144, eleeds@kennesaw.edu

This presentation examines the redesign of managerial communication in the Coles Executive MBA to: (1) to improve the in-person and electronic oral communication skills of the students in dyadic, meeting, group, and public-speaking environments; (2) to focus these skills on influencing decision makers by advancing a specific purpose; and (3) to tailor these skills and contexts to the individuals' professional needs. Communication touch points have been embedded into the 18-month curriculum and focus on the needs of corporate communication and creating an executive presence.

2 - Addressing the Needs of Non-native English Speaking Students in Technical Communication Classes

Maggie Sokolik, Director, Technical Communication Program, University of California, Berkeley, College of Engineering, sokolik@berkeley.edu

The issues faced by non-native speakers (NNSs) of English in technical communications courses are no longer addressed by placement into English as a Second Language courses. Definitions of 'native speaker' have changed, and so our methods for teaching NNSs are changing. I discuss a program for assessing, placing, and teaching non-native speakers (NNSs) of English in engineering technical communications courses at UC Berkeley. I also discuss the extension of these techniques to an interdisciplinary program at Lawrence Berkeley Laboratories.

3 - Effective and Impactful Assessment of Communication and Presentation Approaches (EIACPA Project)

Gisele Ragusa, Associate Research Professor, University of Southern California, Viterbi School of Engineering, ragusa@usc.edu

This presentation provides research on effective assessment metrics for determining the impact of communication approaches and presentation skills. This researcher has designed a set of assessment rubrics that provide "just in time" feedback to the presenter as a real time learning tool for formative improvement of their communication and presentation skills, and summative evaluative metrics to judge and quantify the impact of the presenter's approach. These assessment metrics have been field tested and validated. The results of a recent study will be presented.

■ MA75

C-Room 32A, Upper Level

Practical Application of OR in Rail Industry

Sponsor: Railroad Applications
Sponsored Session

Chair: April Kuo, Senior Operations Research Specialist, BNSF Railway, 2400 Westerncenter Blvd, Fort Worth, TX, 76131, United States of America, April.Kuo@BNSF.com

1 - Risk-Based Railroad Tank Car Safety Design Optimization

Rapik Saat, Graduate Research Assistant, University of Illinois at Urbana-Champaign, B-118 NCEL, MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, mohdsaat@illinois.edu, Christopher P.L Barkan

We will present a quantitative model that accounts for chemical-specific hazard and the consequent benefits and costs to determine the optimal tank car safety design to reduce the risk of transporting hazardous materials. This model is intended to provide a framework to consider cost-effectiveness of using more robust tank car designs to replace an existing tank car fleet in any hazardous material service.

2 - Optimizing the Routing of Trains with Heterogeneous Traffic

Yung-Cheng Lai, Assistant Professor, National Taiwan Universtiy, Rm 313, Civil Engineering Bldg, No 1, Roosevelt Rd, Sec 4, Taipei, 10617, Taiwan - ROC, yclai@ntu.edu.tw, Christopher P.L Barkan, Mark Dingler, Mei-Cheng Shih

Efficient usage of capacity requires understanding how the mixture of traffic interacts to affect capacity. In this research, we develop a new decision support tool to help service design managers determine the most efficient way to route heterogeneous trains through the network. This tool will help railroads maximize the transportation efficiency and thus be better able to provide reliable service to their customers.

3 - Effectively Solving Production Gang Scheduling Problem for Railway Track Maintenance Projects

Gang Li, The University of Texas at Austin, The University of Texas at Austin, Austin, TX, United States of America, gang.li@mail.utexas.edu, Anant Balakrishnan, Brian Roth

The Production Gang Scheduling (PGS) problem seeks to select and assign production gangs to railway track maintenance jobs, sequence the jobs, and route gangs among jobs to minimize the total cost for employing, assigning, and repositioning gangs. The PGS problem has received significant attention in recent years, but solving the problem effectively continues to be challenging. We discuss successful algorithmic approaches for solving this problem.

4 - Ballast Procurement and Delivery Optimization

Xiajun (Amy) Pan, University of Texas at Austin, 1, University Station, Austin, United States of America, Xiajun.Pan@phd.mccombs.utexas.edu, Anant Balakrishnan, Brian Roth

To support annual ballast supply planning for track maintenance projects, we propose an integer programming model that decides the quarry for each project, schedules full-load deliveries to each job site before its project start date, and routes the available trains to make these deliveries. The objective is to minimize the total procurement, vehicle routing, and delivery cost. We describe valid inequalities to strengthen the model, and report on successful computational results using real data.

5 - Freight Tariff Design for Multi-product Multimodal Networks: An MPEC Approach

Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Kuilin Zhang, Jing Dong

We seek to design an optimal tariff scheme for rail freight service, explicitly considering shippers' joint mode and route choice behavior. The problem is formulated as a mathematical program with equilibrium constraints (MPEC), with the objective of maximizing profit of rail carriers and the constraints of achieving stochastic user equilibrium (SUE) network flow pattern. The model is applied to an international rail-based intermodal freight corridor network in Europe.

Monday, 11:00am - 12:30am

■ MB01

C-Room 21, Upper Level

Using Decision Analysis/Value of Information to Improve Defense Against Attacks

Sponsor: Decision Analysis
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 - Trading off Target Hardening Against Overarching Protection
Naraphorn Haphuriwat, naraphoh@cae.wisc.edu, Vicki M Bier

Defenders concerned about protecting multiple targets can protect them either by hardening individual target, or through overarching protections such as border security. Decision-makers may find it difficult to compare such seemingly incommensurate forms of protection. We develop a model for trading off target hardening against overarching protection, and investigate how the optimal tradeoff depends on factors such as the number of targets and the distribution of target valuations.

2 - Jamming Radio-Controlled Improvised Explosive Devices with Reactive Jammers
Kyle Lin, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd, Monterey, CA, 93943, United States of America, kylin@nps.edu

A reactive jamming device first scans the entire frequency spectrum to detect radio signals before deciding which frequency bands to jam. In an urban area, however, there are usually a lot of background radio traffic (besides an RCIED detonation signal) that can confuse the reactive jammer. This talk presents a game-theoretic approach to quantify the effect of the background radio traffic on the reactive jammer's performance.

3 - Defending Against Multistage Attacks under Uncertainty: A Non-Cooperative Non-Zero-Sum Game Approach
Yi Luo, University of Arizona, Department of Systems and Industrial Engineering, 1127 E. James E. Rogers Way, Tucson, AZ, 85721-0020, United States of America, luo1@email.arizona.edu, Youssif Al-Nashif, Salim Hariri, Ferenc Szidarovszky

The interactions between the attacker and the administrator can be modeled as a non-cooperative non-zero-sum dynamic game with incomplete information. Since calculating the equilibrium strategies within certain time horizons cannot provide optimal responsive strategies to the administrator, a new and fast algorithm RMO is developed. The numerical experiments show that the RMO algorithm can largely reduce the impact of the attack to the system and more efficient than the other algorithms.

4 - Optimal Defensive Allocations Based on Realistic Attacker Objective Functions
Chen Wang, University of Wisconsin-Madison, 3237 Mechanical Engineering, 1513 University Ave, Madison, WI, 53706, United States of America, cwang37@wisc.edu, Vicki M Bier

We extend existing game-theoretic models of optimal defensive resource allocations from simple "toy problems" to realistic multi-attribute attacker objective functions. We explore how such decisions depend on the cost effectiveness of defensive investment, the defender's uncertainty about the weights placed by attackers on different attributes such as attack difficulty vs. damage, and the presence of attributes that are important to the attacker but not known to the defender.

5 - Robust Defensive Resource Allocations in the Face of Strategic and Non-strategic Adversaries
Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Xiaojun Shan

Allocating homeland security resources is a challenging problem. In this paper, we study the robust defensive resource allocation, considering the fact that the adversary (terrorist, attacker) could be either strategic or non-strategic. We develop algorithms to solve this problem and provide both analytical and numerical results. We also study the sensitivities of the robust defensive resource allocations and defender payoffs to various assumptions about the adversary behavior.

■ MB02

C-Room 22, Upper Level

Normative Models for Multiattribute Utility Functions

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu

1 - Graphical Representations of Independence for Multiattribute Utility Functions
Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu

We present a graphical representation of preferences, which we call the bidirectional utility diagram, that captures the asymmetric nature of utility independence in decisions with multiple attributes. We also introduce a new expansion theorem for multiattribute utility functions that generalizes the functional form of Bayes' expansion theorem. We show how special cases of this formulation lead to well-known functional forms of utility independence found in the literature.

2 - Consumption and Portfolio Planning Using Multilinear Preferences
Casey Lichtendahl, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, lichtendahlc@darden.virginia.edu, Raul Chao, Sam Bodily

Making lifetime plans about consumption and investment in risky assets is a fundamental economic challenge. Contrary to empirical evidence, leading solutions to this problem recommend erratic consumption plans that move with every instantaneous uptick and downtick in the stock market. We show that a solution to this problem using multilinear preferences recommends consumption plans that are smooth with respect to the noise in the stock market—something no additive preference model can do.

3 - Combining Good with Bad and Multivariate Stochastic Dominance
Ilia Tsetlin, Insead, 1 Ayer Rajah Ave, Singapore, 138676, Singapore, ilia.tsetlin@insead.edu, Robert Winkler

We develop the notions of concave and convex multivariate stochastic dominance, defined through a preference for combining good lotteries with bad ones versus combining good with good and bad with bad. We explore connections with existing concepts of multivariate stochastic dominance and discuss implications for multiattribute decision analysis. Our results also add intuition to such notions as correlation aversion, cross-prudence, and cross-temperance.

■ MB03

C-Room 23A, Upper Level

Game Theory II

Cluster: Game Theory
Invited Session

Chair: Amin SaberiProfessor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

1 - Stochastic Submodular Optimization
Arash Asadpour, Ph.D. Candidate, Stanford University, Terman Engineering Building, Room 323, Stanford University, Stanford, CA, 94305, United States of America, asadpour@stanford.edu, Amin Saberi, Hamid Nazerzadeh

We study stochastic submodular maximization problem with respect to a cardinality constraint. Our model can capture the effect of uncertainty in different problems, such as cascade effects in social networks, capital budgeting, sensor placement, etc. We study non-adaptive and adaptive policies and give "optimal" constant approximation algorithms for both cases. We also show that the adaptivity gap in this setting is 1.59.

2 - Social Influence and Evolution of Market Share
Simla Ceyhan, PhD Candidate, Stanford University, Terman Engineering Building, Room 391, Stanford, CA, 94305, United States of America, simlac@stanford.edu, Mohammad Mousavi, Amin Saberi

We propose a model for the evolution of the market share in the presence of social influence. Using techniques from stochastic approximation theory, we show that market share converge to an equilibrium that can be derived in terms of the level of social influence and inherent fitness of the products. We also show that when the choice model is multinomial logit model, inequality in the market increases with social influence and with strong social influence, monopoly occurs.

3 - Online Stochastic Matching: Beating 1-1/e

Vahab S. Mirrokni, Research Scientist, Google Research, 76 9th Ave, 4th floor, New York, NY, 11206, United States of America, mirrokni@gmail.com, Jon Feldman, Muthu Muthukrishnan, Aranyak Mehta

Motivated by online display ad allocation, we study the online stochastic bipartite matching problem in the iid model. Our main result is a 0.67-approximation online algorithm for this problem, breaking the 1-1/e barrier. Furthermore, we show a hardness result that achieving a PTAS is impossible. In our algorirthm, we employ the idea of the power of two choices by computing two disjoint solutions to expected instance, and use them in the online algorithm.

■ MB04

C-Room 23B, Upper Level

Auctions and Competitive Bidding

Cluster: Auctions
Invited Session

Chair: Octavian Carare, University of Texas at Dallas, 800 W Campbell Rd, Richardson, United States of America, carare@utdallas.edu

1 - Mergers in Repeated Auctions with an Incumbent Advantage

Mikhael Shor, Vanderbilt University, Nashville, TN, United States of America, mike.shor@owen.vanderbilt.edu, Luke Froeb

When the winner of one auction gains a cost advantage in the next, bids reflect not only the value of winning the auction, but also the value of gaining an incumbent advantage in future auctions. Firms face an inter-temporal trade-off between 'harvesting' incumbency status by bidding less aggressively, and 'sowing' incumbency for the next period by bidding more aggressively. We study mergers in this context. The presence of incumbent advantage makes many mergers pro-competitive.

2 - Competition in Art Auctions

Martin Schreiber, PhD Candidate, University of Texas at Dallas, 800 West Campbell Road, SM32, Richardson, TX, 75080, United States of America, mrs055000@utdallas.edu

The study examines the impact of competition between and within art auctions using auction data of Christie's and Sotheby's between 1990 and 2008.

3 - Speculation and Demand Reduction in English Clock Auctions with Resale

Krista Jabs Saral, Florida State University, Department of Economics, 113 Collegiate Loop, Tallahassee, FL, 32306-2180, United States of America, kkj8919@fsu.edu

I theoretically and experimentally examine how the existence of an inter-bidder secondary resale market opportunity impacts bidder behavior in an English clock auction, and to what extent altering the bargaining power of the final buyer and reseller in the resale market determines the strategies followed in the initial auction.

4 - Minority Subcontracting Goals in Government Procurement Auctions

Dakshina De Silva, Associate Professor, Texas Tech University, Department of Economics, Lubbock, TX, 79409, United States of America, dakshina.de-silva@ttu.edu, Timothy Dunne, Georgia Kosmopoulou, Carlos Lamarche

Affirmative action policies for disadvantage business enterprises (DBE) have been under scrutiny for the past 19 years. Such policies have been in place for countering the effects of past discrimination. Their goal has been to enhance the economic strength of minorities and stimulate competition. The opponents of those policies claim that they resulted in reverse discrimination. We use TxDOT data to investigate the effect of DBE goals on participation and the cost of contracting. We apply matching and structural estimation techniques to study differences in the costs.

■ MB05

C-Room 23C, Upper Level

2009 INFORMS Best Paper Award in the Quality, Statistics, and Reliability (QSR) Section

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi GebraeelAssistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, nagi@isye.gatech.edu

1 - A Bayesian Approach to Risk-adjusted Change Detection in Healthcare

Li Zeng, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, LZENG1@WISC.EDU, Shiyu Zhou

Outcomes in medical processes are important measures of care providers' performance. One key challenge in the detection of performance change using outcomes is the need of adjustment for patient base-line risks. This article proposes a Bayesian approach to risk-adjusted detection of performance change.

2 - Bayesian Optimal Single Arrays for Robust Parameter Design

Lulu Kang, Ph.D. Candidate, School of Industrial and Systems Engineering, Georgia Tech, 350440 Gerogia Tech Station, Atlanta, GA, 30332, United States of America, lulu@gatech.edu, Roshan Vengazhiyil

It is critical to estimate control-by-noise interactions in robust parameter design. We propose a Bayesian approach to develop single arrays which incorporate the importance of control-by-noise interactions without altering the effect hierarchy. The approach is very general and places no restrictions on the number of runs or levels or type of factors or type of designs. It is also applied to design experiments with internal noise factors; a topic that has received scant attention in literature.

3 - Sequential Bayesian Decision Making for End-Point Detection of Chemical Mechanical Planarization

Omer Beyca, Oklahoma State University, Stillwater, OK, 74078, United States of America, omer.beyca@okstate.edu, Ranga Komanduri, Zhenyu (James) Kong, Satish Bukkapatnam

AbstractóIn Chemical Mechanical Planarization, endpoint detection decisions are important to enable the process to respond to demand variations and disruptions. In this paper, we apply the sequential Bayesian decision making to establish a relationship that connects the measured sensor signals with the material removal for end-point detection of the process. index Termsó Chemical Mechanical Planarization (CMP), Endpoint Detection (EPD), Sequential Bayesian Decision Making.

4 - Degradation Modeling of Complete,Sparse and Fragmented Degradation Signals

Rensheng Zhou, PhD Graduate Student, Georgia Tech, 1903 DREW Dr. NW Rm1202, atlanta, United States of America, rzhou8@gatech.edu, Nagi Gebraeel, Nicoleta Serban

This paper presents a non-parametric degradation modeling framework for characterizing degradation signals of partially degraded engineering systems. We focus on modeling different types of degradation signals to predict the distribution of a system's residual life using real-time degradation signals. We consider complete signals, sparse signals and fragmented signals which are densely observed at disjoint time intervals. The approach is validated using degradation data of bearings.

■ MB06

C-Room 24A, Upper Level

Quality and Statistical Decision Making in Health Care Applications I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Assistant Professor, Arizona State University, Tempe, AZ. United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, huiyang@eng.usf.edu

1 - An Artificial Neural Network to Quantify Breast Cancer Risk Based on Mammography Findings

Turgay Ayer, University of Wisconsin, 1513 University Ave., Madison, WI, 53708, United States of America, tayer@wisc.edu, Oguzhan Alagoz, Charles Kahn, Elizabeth Burnside, Jagpreet Chhatwal, Jude Shavlik

Although breast cancer is the most common cancer among US women, current methods in practice for diagnosis have low positive predictive values. Unfortunately, no diagnostic system has achieved perfect discrimination, so radiologists must make decisions under substantial uncertainty. We built an artificial neural network (ANN) based on a large dataset to discriminate between cancerous and noncancerous lesions and accurately predict the probability of breast cancer for individual patients.

2 - Multiscale Recurrence Model for Biomedical Diagnostic Applications

Satish Bukkapatnam, Professsor, Oklahoma State University, School of Industrial Engineering and Man, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu, Hui Yang

This paper presents a multiscale recurrence model for the identification of myocardial infarction subjects. Few, if any, of previous approaches study the recurrent dynamics from the cardiac state space constructed with three orthogonal vectorcardiogram (VCG) signals in the wavelet domain. The proposed approach is found to achieve classification performances very close to the human experts and better than traditional automated algorithms.

3 - Learning Brain Connectivity of Alzheimer's Disease by Exploratory Graphical Models

Shuai Huang, PhD Student, Arizona State University, 1025 Orange St, La Cresenta, RM-G220, Tempe, AZ, 85281, United States of America, shuang31@asu.edu, Jing Li

This paper proposes an exploratory graphic model called inverse covariance to model the functional brain connectivity of three study groups including AD, MCI, and normal aging subjects. The developed model is applied to PET data collected when subjects are at their resting state. Results are consistent with previous findings in the literature. Some new aspects are also revealed with added value to the current connectivity research, and are worthy of further investigation.

■ MB07

C-Room 24B, Upper Level

Reliability and Risk Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Refik Soyer, George Washington University, 2201 G Street NW, Funger Hall 415, School of Business, Washington, DC, 20052, United States of America, soyer@gwu.edu

1 - Predictive Information for Reliability Analysis

Ehsan Soofi, Professor, University of Wisconsin-Milwaukee, Sheldon B. Lubar School of Business, P.O. Box 742, Milwaukee, WI, 53201, United States of America, esoofi@uwm.edu, Nader Ebrahimi, Refik Soyer

We examine relationships between measures of information provided by the sample for prediction and about the parameter when the observations are conditionally independent given the parameter and for the order statistics. We also compare predictive information provided by a sample of all failure times and a sample that includes some survival times. Applications to a large family of distribution which contains many well-known lifetime models will be presented.

2 - Duration Models for Mortgage Default Risk

Feng Xu, Assistant Professor of Management, Georgia Southwestern State University, 800 GSW State University Drive, Americus, GA, 31709, United States of America, fengxu@gwmail.gwu.edu, Refik Soyer

In this talk we present duration type models to analyze mortgage default risk. We provide proportional hazards type generalized gamma and mixture models, with which the nonmonotonic default behavior of residential mortgage loans can be captured effectively. Besides, we develop Bayesian inferences for our models and illustrate their implementation using actual time to default data from the U.S. residential mortgage market.

3 - Reliability Growth Prediction for Multi Stage Systems

Thomas Mazzuchi, George Washington University, 1776 Gst NW, Washington DC, United States of America, mazzu@gwu.edu, Jennifer Nicholls, Shahram Sarkani

In this presentation we develop a Bayesian reliability growth model for multisatge systems which takes in to account test and field ddata and allows for potentially different growth rates for each phase.

4 - The Variability Associated with Bayesian Group Maintenance Policies

John Wilson, University of Western, John G. Wilson, Ivey School of Business, ON, Canada, jwilson@ivey.uwo.ca, Elmira Popova

In the literature on replacement / maintenance policies for systems of stochastically failing machines, it is generally assumed that the failure time parameters are known and the objective is to find a replacement policy that minimizes expected cost per unit of time. In practice, however, the variability of costs can be an important consideration. In addition, most managers would want to adapt to new information obtained while operating the machines. In this paper, a class of policies is analyzed where the manager is allowed to adapt the replacement policy according to the statistical information obtained while operating the machines. It will be demonstrated that it is feasible to explicitly calculate both the expected cost per unit time and the variance associated with this class of replacement policies.

■ MB08

C-Room 24C, Upper Level

Joint Session QSR/Data Mining: Multi-factor Approaches to Risk Analysis and Threat Determination

Sponsor: Quality, Statistics and Reliability & Data Mining Sponsored Session

Chair: Artur Dubrawski, Adjunct Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awd@cs.cmu.edu

1 - Risk-Informed Decision Framework for Integrated Chem/Bio Risk Assessment and Management

Igor Linkov, Risk and Decision Science Focus Area Lead, US Army ENgineer Research and Development Center, 83 Winchester Str, Suite 1, Brookline, MA, 02446, United States of America, Igor.Linkov@usace.army.mil, Steven Bennett, Sara Klucking, Todd Bridges, Alex Tkachuk, Natasha Hawkins

This presentation will focus on current and evolving risk management approaches to a wide range of available CBRN countermeasures, taking into account their functional and economical criteria, possible threats and potential targets. It will include discussion on the current DHS need, summaries of probabilistic risk assessment currently implemented by DHS as well as proposed decision-analytical and portfolio-based risk management tools.

2 - Combining Contextual Information and Radiation Measurement Factors for Nuclear Threat Determination

Simon Labov, Physicist, Lawrence Livermore National Laboratory, P.O. Box 808, L-181, Livermore, CA, 94550, United States of America, slabov@llnl.gov, Yiming Yao, John Ostlund, Michael Pivovaroff, Karl Nelson, Dov Cohen, Artur Dubrawski, Saswati Ray

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. We are developing a unique approach that combines factors from contextual information (e.g., location, goods description, etc.) and multiple radiation sensors to provide threat determination analysis. We use machine learning algorithms and physics-based techniques for text enumeration, feature extraction and threat classification.

3 - Time Series-based Data Mining Methods Applied to Aircraft Fleet Operational Risk Management

Norman Sondheimer, University of Massachusetts Amherst, Computer Science Department, Amherst, MA, 06001, United States of America, sondheimer@cs.umass.edu, Artur Dubrawski

This presentation argues that time series-based methods from data mining can be used to manage operational risk in the management of aircraft fleets for higher availability and lower cost. It describes the problem space, proposes a model to employ, compares the model to well-known alternatives, gives examples from experiments with the management of a large fleet, and ends with a set of challenge problems for the field.

4 - Practical Data-driven Methods of Risk Estimation in Food Safety Applications

Artur Dubrawski, Adjunct Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awd@cs.cmu.edu, Lujie Chen, Daria Sorokina

Food safety is an important prerequisite of public well being. We present selected data-driven methods of risk estimation applied to model positive results of microbial tests of food samples collected at production plants. Knowledge of risk enables proactive allocation of investigative resources and it supports studies into mitigation of food-borne threats to public health. We illustrate empirical utility of the presented methods using a record of tests against various serotypes of Salmonella.

■ MB09

C-Room 25A, Upper Level

Applications in Revenue and Operations Management

Sponsor: Applied Probability
Sponsored Session

Chair: Hernan Awad, University of Miami, Department of Management Science, Coral Gables, FL, 33124-6544, United States of America, h.awad@miami.edu

1 - Optimal Flexibility Configurations in Newsvendor Networks: Going Beyond Chaining and Pairing

Achal Bassamboo, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, 60208, a-bassamboo@kellogg.northwestern.edu, Jan Van Mieghem, Ramandeep Randhawa

In this talk, we characterize optimal flexibility configurations in newsvendor models. We find that though chaining configurations yield good performance, they are not optimal in general, and one has to add additional flexibility. Further, we show that when faced with arrival rate uncertainty, queueing systems reduce to newsvendor models, and thus our results apply to these settings as well.

2 - Optimal Dynamic Assortment Planning

Denis Saure, Columbia University, 3022 Broadway, Uris Hall, 4N, New York, NY, 10025, United States of America, dsaure05@gsb.columbia.edu, Assaf Zeevi

We study a family of stylized assortment planning problems, where arriving customers make purchase decisions among offered products based on maximizing their utility. By offering different assortments and observing purchase behavior, the retailer learns about consumer preferences, but experimentation should be balanced with exploitation of this knowledge. We develop dynamic policies that balance the aforementioned trade-off, and prove that the performance of these policies is best possible.

3 - A Characterization of the Value of Uncensored Demand in Inventory Management

Omar Besbes, Columbia University, Graduate School of Business, 3022 Broadway, Uris Hall, New York, 10027, United States of America, ob2105@columbia.edu, Alp Muharremoglu

We consider a newsvendor problem where the decision-maker does not have access to the underlying distribution of demand. We provide a characterization of the best achievable performance in the cases where demand observations are censored and uncensored, thereby quantifying the performance degradation stemming from demand censoring.

4 - Inventory Control Policies for Fixed-life Perishable Products

Hernan Awad, University of Miami, Department of Management Science, Coral Gables, FL, 33124-6544, United States of America, h.awad@miami.edu

We study the problem of a firm manufacturing a perishable product (with a fixed deterministic shelf-life), who must choose its production/inventory policy to minimize the costs of unsatisfied demand, inventory holding and product outdating. For a parameter regime of high demand and production rates, we formulate a diffusion approximation to the system and, based on it, develop production/inventory policies that attain good performance. Joint work with Mariana Olvera-Cravioto.

■ MB10

C-Room 25B, Upper Level

Computation/Communication Resource Management

Sponsor: Applied Probability
Sponsored Session

Chair: Lydia Chen, Visiting Scientist, IBM Zurich Research Lab, 4 Sauemerstrasse, Rueschlikon, Switzerland, YIC@zurich.ibm.com

1 - The Optimality of Security-Level Strategies in Adversarial Settings

Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

We consider devising a pit stop strategy in Formula One (F1) racing. We formulate an F1 race as a full-information game in Nash and show how to solve for competitor utility profiles from data. We show that the game compels risk-averse play and matches well with a game class where security-level strategies are optimal. We conclude by showing that our game-theoretic approach outperforms other methods, and discuss the application of our methods to other domains like R&D portfolio investment.

2 - The Content Management for P2P IPTV System

Lydia Chen, Visiting Scientist, IBM Zurich Research Lab, 4 Sauemerstrasse, Rueschlikon, Switzerland, YIC@zurich.ibm.com

We propose a stochastic framework to study content management policiesfor the hierarchical IPTV system with the option of peer content sharing. The steady state analysis provides the content distribution, which is used to evaluate the efficiency of the peer-sharing of network and storage resources. We show that dynamic content management with different degrees of peer collaborations can be nearly optimal, with respect to the video popularity and system specifications.

3 - Input-Output Similarities at FIFO Queues

Florin Ciucu, T-Labs / TU-Berlin, Ernst-Reuter-Platz 7, Berlin, 10587, Germany, florin@net.t-labs.tu-berlin.de

A recent approach for queueing analysis proposed a bounding representations of arrivals and service. In this talk we address input-output relationships at a FIFO queue with multiple arrival flows. In particular, we show that for a broad class of arrivals the input and output of a single flow have very similar bounds. This result indicates that queues in a network can be treated in isolation of each other, thus considerably simplifying the end-to-end analysis.

4 - Adaptive Resource Allocation in Data Centers

Natarajan Gautam, Texas A&M University, 3131 TAMU, 235A Zachry, College Station, TX, 77843, United States of America, gautam@tamu.edu, Cesar Rincon Mateus

We study the Energy Aware Dynamic Resource Allocation problem for data centers. We propose a decision making scheme that efficiently adapts to system behavior changes consisting of a reactive mechanism that uses the information about the current state of the system, and a proactive mechanism that is based on information obtained from a novel custom-made forecasting procedure. The scheme is highly adaptive to system conditions and/or disruptions.

■ MB11

C-Room 25C, Upper Level

Homeland Security and Counterterrorism

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Lawrence M Wein, Stanford University, Graduate School of Business, Stanford, CA, United States of America, wein_lawrence@gsb.stanford.edu

1 - Inference and Interdiction in a Terror Queue Model

Edward H Kaplan, William N and Marie A Beach Prof of Mgt Sciences, Prof of Public Health and Prof of Engineering, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, edward.kaplan@yale.edu

We continue our discussion of a new queueing model relating terror threats and their detection by HUMINT agents to understand how preventive counterterror measures and HUMINT combine to interdict terror suspects. We also gauge the number of undetected terror plots in progress from the known utilization of HUMINT agents.

2 - Securing the Containerized Supply Chain: Analysis of Government Incentives for Private Investment

Nitin Bakshi, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nbakshi@london.edu, Noah Gans

To mitigate the threat of terrorists smuggling weapons of mass destruction (WMD) into the US through maritime containers, the US Bureau of Customs and Border Protection (CBP) inspects containers upon entry to domestic ports. Inspection-driven congestion is costly, and CBP provides incentives to firms to improve security upstream in the supply chain, thereby reducing the inspection burden at US ports. We perform a game-theoretic analysis of this incentive program.

3 - An Overlapping Networks Approach to Counterterrorism Resource Allocation

Michael Atkinson, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, mpatkins@nps.edu, Lawrence Wein

We formulate a model to identify terrorists through their participation in criminal networks such as money laundering and dealing in illicit drugs. The government allocates resources among these networks to maximize the number of terrorists identified, but has only limited information about the structures of these networks. The government performs both an initial global investigation and a secondary local investigation. We illustrate the model with data from the American Terrorism Study.

■ MB12

C-Room 26A, Upper Level

Advances in LP Modeling of Combinatorial and Stochastic Optimization Problems

Sponsor: Computing Society
Sponsored Session

Chair: Moustapha Diaby, Associate Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06268, United States of America, moustapha.diaby@business.uconn.edu

1 - Transportation Problem-Based Heuristics for the Set Partitioning Problem

Aaron Nsakanda, Associate Professor, Carleton University, Sprott School of Business, 1125 Colonel By Drive, Ottawa, ON, K1S 3B6, Canada, aaron_nsakanda@carleton.ca, Anito Joseph-Phillip, Moustapha Diaby

We propose a new, graph-based modeling approach for the Set Partitioning Problem. The approach is illustrated with a numerical example. Computational testing and results are discussed.

2 - Pattern Recognition Techniques in Stochastic Programming

Miguel Lejeune, Assistant Professor, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

A new modeling framework based on pattern recognition techniques is proposed for the solution of stochastic programming problems. The method involves the binarization of the probability distribution and the generation of a disjunctive normal form representing sufficient conditions for stochastic constraints to hold. The disjunctive normal form is modeled as a collection of logical patterns. A mathematical programming approach is used to construct the patterns.

3 - Concise RLT Forms of Binary Programs: A Computational Study of the Quadratic Knapsack Problem

Richard Forrester, Associate Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States of America, forrestr@dickinson.edu, Warren Adams, Paul Hadavas

The RLT is a methodology for constructing tight LP relaxations of mixed discrete problems. A key construct is the multiplication of "product factors" of the discrete variables with problem constraints to form polynomial restrictions, which are subsequently linearized. We examine the usefulness of subsets of constraints for the 0-1 quadratic knapsack problem. We consider RLT forms both with and without these inequalities, and their comparisons with linearizations derived from published methods.

4 - Generalized Framework for Formulating "Hard" Combinatorial Optimization Problems as Linear Programs

Moustapha Diaby, Associate Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06268, United States of America, moustapha.diaby@business.uconn.edu

In this talk, we will present a general framework for formulating "hard" combinatorial optimization problems as linear programs (LP's). Insights into why traditional IP modeling approaches fail (w.r.t. to formulating problems as LP's) will be discussed. Some numerical illustrations of the proposed general framework will also be discussed.

■ MB13

C-Room 26B, Upper Level

Computational Stochastic Integer Programming

Sponsor: Computing Society
Sponsored Session

Chair: David Morton, Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States of America, morton@mail.utexas.edu

1 - Nuclear Medicine Patient and Resource Scheduling via Stochastic Integer Programming

Eduardo Perez, Graduate Student, Texas A & M University, 3131 TAMU, College Station, TX, United States of America, eduardopr@neo.tamu.edu, Cesar O. Malave, Lewis Ntaimo

Nuclear medicine (NM) procedures use radioisotopes for diagnosis and treatment of patients, involve multiple steps, and have to be performed under strict time constraints and uncertainty in patient/radioisotope arrivals. This makes the problem of NM patient service management very challenging. We present stochastic integer programming models for NM patient/resource scheduling within a stochastic online optimization framework. A computational study based on an actual NM clinic will be presented.

2 - Parallelization of Progressive Hedging Revisited: Asynchronous Convergence and Scenario Bundling

David Woodruff, Professor, University of California Davis, UC Davis, Davis, CA 95616, Davis, CA, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson

Although Progressive Hedging is naturally parallelizable, a number of unexplored issues arise for efficient implementation. In particular, asynchronous sub-problem solves facilitate improved efficiency, but may adversely impact algorithm convergence. Similarly, intelligent bundling of scenarios may accelerate local convergence, but degrade global convergence. We explore the practical implementation of these techniques, and discuss computational results on various test problems.

3 - Prioritization via Stochastic Optimization

Ali Koc, The University of Texas at Austin, alikoc@mail.utexas.edu, David Morton, Elmira Popova

The operations research literature handles activity selection problems by forming an optimal portfolio of activities, as opposed to a common approach in industry which forms a prioritized list. We develop a novel prioritization approach incorporating both views. We illustrate our approach on stochastic k-median and capital budgeting models. We formulate two-stage and multi-stage stochastic integer programs and develop valid inequalities. We use parallel branch-cut-price to improve solution time.

■ MB14

C-Room 27A, Upper Level

Optimization in Practice II - Manufacturing

Sponsor: Computing Society
Sponsored Session

Chair: Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Integrating Inventory Optimization and Supply Chain Network Optimization Models

Jeremy Shapiro, Professor Emeritus, MIT, 226 Commonwealth Ave., Boston, MA, 02116, jfsinc@attglobal.net

Supply chain network optimization models are applied to strategic planning problems involving facility location decisions and tactical planning problems involving production and distribution decisions. We discuss how modeling artistry can be employed to incorporate inventory decisions about safety stocks and replenishment quantities in network optimization models. A successful case study will be presented.

2 - Prescriptive Analytics Produces Millions in Profits in Manufacturing

Andrew Bielat, President & CEO, EIS Analytics, 16004 NE 203rd Court, Brush Prairie, 98606, United States of America, abielat@eisanalytics.com

EIS Analytics has taken analytics to a new level for manufacturing clients that industry experts have christened "persecriptive analytics". Using LP, heuristics, Monte Carlo simulations and other analytical techniques, combined with Activity Based Costing and an in depth understanding of organizational dynamics, their Profit InSight tools are making clients millions of dollars a year in profit.

3 - MPS Optimization

Robert Wang, Sr. Business Analyst, Nestle USA, 800 N. Brand Blvd., Glendale, CA, 91203, United States of America, robert.wang@us.nestle.com

A MIP model was developed to optimize master production schedule, which was maintained manually in the past. The model minimizes the total costs including inventory, change over, production, shortage and salvage. Sequence dependent change over is specifically addressed in the model. About 40% inventory reduction has been attained.

4 - Integration of Systems, Process and Optimization at Hub Group

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

This talk presents a multi-component DSS which combines forecasting and statistics with heuristics and optimization to provide yield management and load dispatching capabilities at Hub Group, the largest Intermodal marketing Company in the U.S. We discuss the challenges of living within existing organizational, system and process constraints when developing new O.R.-based decision technology.

■ MB15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Innovative Scheduling - Case Studies From the Field: What It Takes to Turn Models into Systems

Ravindra Ahuja, President, Innovative Scheduling, GTEC, 2153 SE Hawthorne Road, Suite 206, Gainesville, FL, 32641, United States of America, ravi@innovativescheduling.com

In this tutorial, attendees will learn what it takes to build successful model-based systems and how theory can be brought to practice to create success stories for the discipline. We will describe several business problems, their modeling, packaging into decision support systems, difficulties encountered, how we addressed them, and the lessons learned.

2 - Maximal Software - Why is Maximal Software Now Giving Away Free Development Copies of MPL?

Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

In today's challenging economy, many are now looking for ways to save on their IT budget, including when purchasing optimization software. We at Maximal have now decided to fundamentally change how we sell our software, by greatly reducing how much you pay for development copies of MPL, in many cases bringing the actual cost down to zero. We will explain several new programs: "Pay Maintenance Only, "Subscription-Based Pricing," "Free Development Copies of MPL" and "Free Software for Academics."

■ MB16

C-Room 28A, Upper Level

Information Security

Sponsor: Information Systems
Sponsored Session

Chair: Dmitry Zhdanov, University of Connecticut, 2100 Hillside Rd, Storrs, CT, 06269, United States of America, Dmitry.Zhdanov@business.uconn.edu

1 - Personal Data Protection: Economic and Legal Perspectives of Regulation, Liability and Information Disclosure

Sasha Romanosky, Carnegie Mellon, United States of America, sromanos@andrew.cmu.edu, Alessandro Acquisti

We analyze personal data protection laws in the United States through the lenses of the economic theories of ex ante safety regulation, ex post liability and information disclosure. Specifically, we consider and contrast how legal and economic theories interpret privacy costs and the remedies to those costs and highlight conditions under which these regimes may become socially inefficient.

2 - Managing Interdependent Security Risks

Xia Zhao, Assistant Professor, University of North Carolina-Greensboro, Bryan 479, ISOM Dept, University of North Carolina-Greensboro, Greensboro, NC, 27402, United States of America, x_zhao3@uncg.edu, Ling Xue, Andrew Whinston

We examine how firms can address investment inefficiency caused by network externalities of information security investments using three risk management approaches-cyberinsurance(CI), Risk Pooling Arrangement(RPA), and Managed Security Service(MSS). We find the combination of CI and RPA can only be used to address investment inefficiency associated with negative externalities of security investments. With MSS, firms can endogenize both positive and negative externalities of security investments.

3 - Investors' Reactions to Information Security Incidents and Short-Term Profitable Investment Opportunities

Jackie Rees, Purdue University, United States of America, jrees@purdue.edu, Karthik Kannan, Ta-Wei Wang

This paper investigates investors' reactions to breach announcements. The results show that, from the sophisticated investors' perspective, security incidents do not affect a firm's future performance and the textual contents of news articles affect unsophisticated investors' reactions. Different perceptions among investors regarding security incidents provide profitable short-term investment opportunities

4 - Roles of Information Security Awareness and Perceived Fairness in Information Security

Hasan Cavusoglu, Assistant Professor, University of British Columbia, Sauder School of Business, Vancouver, BC, V6T0A2, Canada, Hasan.Cavusoglu@sauder.ubc.ca, Burcu Bulgurcu, Izak Benbasat

We investigate two factors that drive an employee to comply with requirements of the information security policy of her organization with regards to protecting information and technology resources: an employee's information security awareness (ISA) and her perceived fairness of the requirements of the ISP. Our results show that ISA and perceived fairness positively affect attitude, and in turn attitude positively affects intention to comply. ISA also has an indirect impact on attitude.

■ MB17

C-Room 28B, Upper Level

Information Systems II

Contributed Session

Chair: Elahe Javadi, PhD Student, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S Sixth ST, Champaign, IL, 61820, United States of America, ejavadi2@illinois.edu

1 - A Co-opetition Perspective on Firm Entry Strategy in Standard-setting Organizations

Juliana Tsai, Doctoral Program in Information Systems, Arizona State University, W. P. Carey School of Business, Tempe, AZ, 85287, United States of America, juliana.tsai@asu.edu, Robert Kauffman, Benjamin Shao

Co-opetition, a strategy of cooperation and competition, is observed in firms that join industry forums. We use event history analysis models to study the extent to which business strategies are characterized by co-opetition in firm entry timing in an SSO. We study a consortium that creates process standards and analyze 73 U.S. public firms over 20 years. Our results show that participation varies with firm heterogeneities and the intertemporal dynamics of firm valuations for SSO participation.

2 - An Electronic Market Framework for Applying Multi-agent to Support Collective Purchasing

Ma XuBu, The School of Management Xi'an Jiao Tong University, Xi'an Jiao Tong University, Xi'an, China, whuama@gmail.com, Guo Ju E, Wang Hua

This article builds a multi-agent based semi-automated electronic market framework supports collective purchasing. First analyses the overall structure and transaction process of this market. Second put forward the functions of the multi-agent. Third divided the negotiation process into two stages of negotiation among members and negotiation between brokers and sales, and adaptive-AHP is applied in the negotiation mechanism. Finally, through an example show the whole process of the transaction.

3 - An Empirical Analysis of Customer Service on the Internet

Sang Pil Han, Doctor, New York University, 44 West 4th Street, Room 8-178, Stern School of Business, New York City, NY, 10012, United States of America, sangpil78@gmail.com, Wenling Hsu, Ann Skudlark

This paper focuses on email customer service and examines how firms can improve customer satisfaction through effective email customer service operations. We build a hierarchical Bayesian modeling framework in which we estimate the impact of email customer service features on customer satisfaction. Results show that customer preferences are highly diverse. We find that customers who expressed negative emotion in emails they sent are highly responsive to service representatives response style.

4 - Investigation of Market Volatility Impact on Trading Strategy Performance Using Simulation

Chris Parker, PhD Candidate, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, cparker.phd2007@london.edu, Bruce Weber

We examine the impact of market volatility on trading strategy performance. To investigate this we adapt the classic approach of modeling the market using informed traders and noise traders. By simulating multiple informed and noise traders in an agent-based simulation, we can test for differences in market metrics for three configurations of four trading strategies in nine volatility levels. Our results indicate that the market volatility has an impact on trading strategy performance.

5 - Improving Quality in Computer-mediated Group Ideation: A Random Walk Model

Elahe Javadi, PhD Student, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S Sixth ST, Champaign, IL, 61820, United States of America, ejavadi2@illinois.edu, Judith Gebauer, Wai-Tat Fu

We develop a random walk model of idea quality in a computer-mediated group ideation environment. The model is composed of a drift and a variance function, which represent individual's learning and the inherent volatility of the idea quality respectively. The model provides an integrated explanation of the influence of interface attributes on idea quality. Our findings will provide guidelines for the design of user interfaces that facilitate group ideation success.

■ MB18

C-Room 28C, Upper Level

Markov Decision Processes in Healthcare

Sponsor: Computing Society
Sponsored Session

Chair: Nedialko Dimitrov, The University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, ned.dimitrov@gmail.com

1 - A Decision Process for Resolving Location Uncertainty in Laproscopic Surgery

Farhad Ghassemi, Center for Health Care Management, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, farhad.ghassemi@chcm.ubc.ca, Steven Shechter, Martin Puterman, Christopher Nguan

While an analysis of pre-operative data in laproscopic surgery may suggest possible locations of critical structures, there is still considerable uncertainty of their locations during the surgery. In this talk, we employ the theory of Markov decision processes to facilitate decision making in this type of surgery. We consider one and two-dimensional models of the problem, and provide analytical and numerical results on the structure of the optimal policies.

2 - Stabilizing Hospital Occupancy through Admission Control

Shervin Ahmadbeygi, University of Michigan-Ann Arbor, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, shervin@umich.edu, Mark Van Oyen, Jonathan Helm

Variability in hospital occupancy negatively impacts the cost and quality of patient care delivery through increased congestions, emergency diversions, cancelations, radiology backlogs, overstaffing and understaffing. In this research we present a stylized Markov Decision Process model to analyze the relationship between hospital occupancy and admission decisions. Our goal is to understand how admission decisions when linked to inpatient census, can effectively reduce occupancy variations.

3 - Computing Interventions for Vector Borne Diseases

Nedialko Dimitrov, The University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, ned.dimitrov@gmail.com, David Morton, Sahotra Sarkar, Stephen Szymanski

We model geographic vector borne disease movement as a random walk that is informed by the underlying geographic area suitability for the disease vectors and reservoirs. We use Markov decision process design to compute disease intervention locations with the aim of preventing the disease from reaching critical, high-population areas. We illustrate our methods by computing Leishmaniasis intervention strategies in Texas, an area where Leishmaniasis has historically spread northward.

■ MB19

C-Room 28D, Upper Level

Innovations in Vehicle Routing Modeling

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu

1 - Strategic Thinking and Risk Taking in Route Choice: An Experimental Approach

Michael Razo, Research Assistant, University of Massachusetts Amherst, 141 Marston Hall, 130 Natural Resources Rd., Amherst, MA, 01003, United States of America, mike.razo@gmail.com, Song Gao

This research investigates route choice behavior in networks with risky travel times and real-time information. A study is conducted in which subjects use a PC-based interactive map to choose routes link-by-link in various scenarios. The results are analyzed to determine whether the subjects use strategies which account for en route information in route planning. Several forms of generalized route choice models are estimated and compared.

2 - A Prospect Theory Approach to Modeling Adaptive Route Choices in Risky Traffic Networks

Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu, Emma Frejinger, Moshe Ben-Akiva

We present an adaptive route choice model capturing travelers' strategic behavior in a stochastic network with traffic information, based on the cumulative prospect theory (CPT). It is estimated using synthetic data along with a model based on expected utility. The prediction results indicate large differences in path share predictions and demonstrate the flexibility of the CPT model to represent varying risk attitudes depending on the outcome probabilities.

3 - Online Sequential Routing with Link Failures

David Fajardo, University of Texas at Austin, Department of Civil Engineering, Earnest Cockrell Jr. Hall, 6.202, Austin, TX, 78705, United States of America, davidf@mail.utexas.edu, Travis Waller

We consider a routing problem in a network with link failures where the objective is to sequentially route vehicles in order to determine whether or not a path exists between a certain origin and destination, assuming a vehicle is no longer functional if it encounters a link failure. We propose a Dynamic Programming formulation, and develop bounding procedures for optimal routing schemes.

4 - A Link-based Day-to-day Traffic Dynamic Model

Xiaozheng He, University of Minnesota, 500 Pillsbury Dr. SE, 122 Civil Engineering Building, Minneapolis, MN, 55455, United States of America, hexxx069@umn.edu, Xiaolei Guo, Henry Liu

We propose a day-to-day traffic dynamic that directly deals with link flows, in contrast with traditional path-based models which are built upon path flows. A path flow non-uniqueness shortcoming inherent in all path-based models is identified. This shortcoming shows that different initial path flow patterns, although constituting the same link flow pattern, generally produce different day-to-day link flow evolutions. The proposed link-based dynamic avoids this shortcoming and its fixed point.

■ MB20

C-Room 28E, Upper Level

Containerized Freight Transportation

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Mark TurnquistProfessor, Cornell University, 309 Hollister Hall, Ithaca, NY, 14853, United States of America, mat14@cornell.edu

1 - The Effect of Oil Price on Containership Speed & Fleet Size

David Ronen, Professor, University of Missouri-St. Louis, College of Business Admin., 8001 Natural Brdg. Rd., St. Louis, MO, 63121, United States of America, david.ronen@UMSL.edu

Slow steaming may save a small fortune when bunker fuel prices rise. We analyze the tradeoff between bunker fuel price on the one hand and sailing speed and fleet size on the other hand. A simple procedure is proposed to determine the optimal speed and fleet size of container liners.

2 - Shared Stacking Policy for Stacking Export Containers at Container Yards

Amir Hossein Gharehgozli, PhD Candidate, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, AGharehgozli@rsm.nl, Rene De Koster, Jan Tijman Udding, Yugang Yu

Reshuffling is very costly and time consuming in retrieving containers. In order to minimize the number of reshufflings, this paper proposes a dynamic programming model to determine stacking positions of incoming containers. A shared stacking policy is applied, which allows containers of multiple ships to share a common stacking area. DP can only provide optimal solutions for small scale problems in a reasonable time. Using these solutions, we develop a heuristic to solve large scale ones.

3 - Easy or Hard? An Empirical Examination of Stacker Crane Problems With Implications for Solvability

F. Jordan Srour, PhD Candidate, Rotterdam School of Management, Erasmus University, Burg. Oudlaan 50, Rotterdam, 3062PA, Netherlands, JSrour@rsm.nl, Rob Zuidwijk, Steef van de Velde

Many real-world Stacker Crane Problem (SCP) instances, (i.e. truckload pick-up and delivery problems with a single vehicle), are quickly solved to optimality despite general membership of the SCP in the class of NP-hard problems. We ask the question: "From an empirical standpoint, what makes an SCP easier/harder than a general asymmetric traveling salesman problem?"

4 - Import/Export Container Flow Modeling and Disruption Analysis
Mark Turnquist, Professor, Cornell University, 309 Hollister Hall, Ithaca, NY, 14853, United States of America, mat14@cornell.edu, Julie Lloyd, Scott Ostrowski, Orr Bernstein, Linda Nozick, Carmen Rawls, Dean Jones, Chad Davis, Adam Turk, Brian Levine

We describe a global network model of container flows for U.S. imports and exports. The model includes 46 foreign countries, 14 major North American ports and 84 U.S. analysis zones. It allows estimates of flow diversions between U.S. ports as a result of implementation of security initiatives or occurrence of port disruptions. The model also estimates rail and truck flows within the U.S. and forms the basis for assessing economic costs of events that disrupt import/export flows.

■ MB21

C-Room 30B, Upper Level

Transportation Asset Management and Investment

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Srinivas Peeta, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, United States of America, peeta@purdue.edu

1 - Analysis of the Motorway Infrastructure Concession Using Performance Indicators
Mariana Rodgrigues Brochado, marianabrochado@gmail.com, Javier Faulin

This paper proposes a procedure for the assessment and prioritization of performance indicators of the motorway infrastructure concessionaries' activities in Brazil. A survey with experts was performed using the Quality Function Deployment-QFD. Thus, a quantitative analysis relates the user's required quality with the technical quality of the road, using a methodology of value theory. Likewise, monitoring activities were prioritized and the road performance control indicators defined.

2 - Optimal Private-Sector Investment on a General Road Network under Alternative Market Entry Regulations
Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu

This paper develops models of market entry, price, and capacity choices on a general network to analyze private toll roads for both regulatory and investment decision-making. Several market entry regulations on private toll roads, including free entry, revenue sharing, toll restrictions, and competitive bidding, are considered, and the resulting optimal private-sector investment decisions derived.

3 - Equilibrium Analysis of Interdependent Infrastructure Systems
Srinivas Peeta, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, United States of America, peeta@purdue.edu, Pengcheng Zhang

There is an increasing need to capture interdependencies among infrastructure systems to address design, planning, and operational efficiencies. We propose a generalized framework to study this problem under an equilibrium setting by combining a multilayer network approach with a market-based economic approach. Numerical experiments are used to generate insights on the implications of interdependencies as well as the model capabilities.

4 - Parking Garage Infrastructure Problem: Optimizing for PHEVs V2G Operations
Seok Kim, Graduate Research Assistant, Texas A&M University, Department of Civil Engineering, College Station, TX, 77843, kimseoksaroi@tamu.edu, Ivan Damnjanovic

Plug-in Hybrid Electric Vehicles (PHEVs) are becoming increasing more popular. These vehicles can be connected to a power grid in order to charge or discharge the vehicle battery. In presence of V2G technologies, parking garage developers have an opportunity to gain revenue not only from the parking fees, but also from contracts with the aggregators in electricity markets. This study presents a model for determining optimal parking garage location and the incentive structure.

■ MB22

C-Room 30C, Upper Level

Transport Operations

Contributed Session

Chair: David Kim, School of MIME, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu

1 - Solving Hierarchical Problems via Multi-objective Optimization
Mihalis Golias, University of Memphis, 104 Engineering Science Bldg, Memphis, TN, 38152, United States of America, mihalisgolias@yahoo.com, Georgios K.D. Saharidis

Assignment problems appear frequently in different engineering fields like transportation engineering, electrical engineering, network optimization etc. These problems often have different and conflicting objectives that can be captured by multi-objective and hierarchical formulations of mathematical programs. In this paper we clarify the relation between bi-level and bi-objective problems applied in a group of assignment problems.

2 - Fleet Asset Utilization & Implications on Cost and Equipment Replacement
David Kim, School of MIME, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu, Tristan Wagner

The methods for assigning vehicles in a fleet to tasks will have implications on the overall cost of operating a fleet. We compare different strategies for assigning vehicles with respect to total cost. Data from actual fleets will be presented that demonstrates trends in vehicle utilization resulting from a common method of assigning vehicles to tasks. The implications on vehicle replacement analysis will also be presented.

■ MB23

C-Room 30D, Upper Level

DIME/PMESII Pt 3

Sponsor: Military Applications Society
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Modeling and Visualization in Maritime Piracy Networks
Philip Fellman, Professor, Southern New Hampshire University/Big Sky LLC, 2500 North River Road, Manchester, NH, 03106, United States of America, shirogitsune99@yahoo.com, Dinorah Frutos, Nathan Thanakijsombat, Pard Teekasap, Stan Renard

Maritime piracy has been on the rise for years and the distinction between terrorism and piracy has often been unclear. We investigate the period 1998-2007 using social network analysis and dynamic network analysis software modeling tools in order to obtain a more finely tuned data visualization and modeling of maritime piracy, particularly with respect to location and frequency.

2 - Human Domain Modeling in Support of Military Operations
Richard Pei, Chief, Modeling and Simulation, Army CERDEC I2WD, Director, I2WD, McAfee Center, Fort Monmouth, NJ, 07746, United States of America, Richard.Pei@us.army.mil, Gary Citrenbaum

US Army I2WD is establishing a testbed for vetting human domain models and their underpinning usage concepts. Progress will be reported on efforts to integrate PMESII and HSCB models and tools together within a robust modeling framework to form a HSCB - PMESII enabled modeling capability so that new Concept of Operations can be developed and executed for a variety of military operations at all echelons or command.

3 - Irregular Warfare Focused Intelligence, Surveillance, Reconnaissance, Analysis and Planning
Gary Citrenbaum, President /Chief Scientist, SoSACorp, 3877 Fairfax Ridge Rd Suite 201C, Fairfax, VA, 22030, United States of America, gcitrenbaum@sosacorp.com

In response to urgent requirements to improve support to IW and COIN Operations, DoD has begun developing new doctrine, TTPs, & tools. However, as we see it, the improvements being considered are only a necessary first step. The shortfall, as we see it, lies in our inability to effectively leverage: the data explosion, modern collection assets, and modern, albeit non-traditional models. In this paper we will discuss the shortfall & offer concrete recommendations on how to begin solving it.

■ MB24

C-Room 30E, Upper Level

Tutorial: Using DOE Methods for Efficient Simulation

Sponsor: Military Applications Society
Sponsored Session

Chair: Tom Donnelly, SAS Institute Inc., 27 Farmingdale Ln, Newark, DE, 19711-4392, United States of America, tom.donnelly@jmp.com

1 - Design of Experiments for Efficient Simulation
Tom Donnelly, SAS Institute Inc., 27 Farmingdale Ln, Newark, DE, 19711-4392, United States of America, tom.donnelly@jmp.com

Design of Experiments (DOE) methods for efficiently extracting the most useful information from simulations will be demonstrated. A sequential design approach will show how to run the fewest simulations needed to do sensitivity analysis or to develop a fast-running surrogate model. Solutions will include the application of both traditional DOE to discrete event and agent-based simulations and space-filling designs to more complex physics-based simulations using Computational Fluids Dynamics.

■ MB25

C-Room 31A, Upper Level

Industry Studies Association Joint Session: Creating a Forum for Industry Studies in Passenger Aviation

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

1 - Creating a Forum for Aviation Industry Studies
Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

In this session, we will discuss the growing field of Industry Studies and how hands-on observation and analysis of the airline industry can shape the research conducted by the OR community.

2 - How Does Information Sharing Impact ATFM Decisions?
Thomas Vossen, University of Colorado, 955 Regent Drive, Boulder, CO, 80309, United States of America, vossen@colorado.edu

The Collaborative Decision-Making paradigm has introduced a number of initiatives that emphasize information sharing and common situational awareness. We analyze how these initiatives can impact ATFM decisions, by considering airport acceptance rate planning during Ground Delay Programs. Using theoretical models that optimize airport acceptance rates given demand uncertainty, we evaluate whether the predicted rate changes that would occur with information sharing can be observed in practice.

3 - Dynamic and Static Robustness - Two Sides of the Same Coin?
John-Paul Clarke, Associate Professor, Georgia Institute of Technology, School of Aerospace Engineering, 270 Ferst Drive NW, Atlanta, GA, 30332, United States of America, johnpaul@gatech.edu

Recent studies have shown that more robust airline schedules can be developed by correlating block and ground times with expected delay in different phases of flight. However, the resulting schedules are often not amenable to aircraft and crew swaps, the most often used tactic for dealing with actual disruptions. I introduce the concepts of static and dynamic robustness within the context of airline scheduling and present a methodology for combining them to mitigate the effects of disruptions.

■ MB26

C-Room 31B, Upper Level

Edelman Finalists Reprise - I

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

1 - Decision Engineering at Intel Corporation (The 2009 INFORMS Prize Winner)
Karl Kempf, Intel Corporation, 5000 W. Chandler Blvd., MS-CH3-10, Chandler, AZ, 85226, United States of America, karl.g.kempf@intel.com

The 2009 INFORMS Prize was awarded to the Intel Decision Engineering Group. By employing an array of OR/MS disciplines, and a process to diffuse them, the Decision Engineering Group has impacted a vast and diverse set of Intel's functions including product design, demand forecasting, factory development, pricing structures, equipment and material acquisition, and production-inventory-logistics planning. These applications have contributed more than $4 billion in improved decision making.

2 - Zara Uses Operations Research to Reengineer its Global Distribution Process
Jeremie Gallien, MIT Sloan School of Management, 50 Memorial Drive, Cambridge, United States of America, jgallien@mit.edu, Javier Garcia, Jose Manuel Corredoira, Marcos Montes, Jose Antonio Ramos, Juan Correa, Felipe Caro

Overcoming significant technical and human difficulties, Zara recently deployed a new process relying extensively on sophisticated Operations Research models to determine every single shipment of inventory it sends from its two central warehouses to its 1500 stores worldwide. This new process has increased sales by an estimated 3-4%, corresponding to an estimated realized impact of approximately $233M and $353M in additional revenues for 2007 and 2008, respectively.

■ MB27

C-Room 31C, Upper Level

Advances in Monte Carlo Methods and Applications to Finance and Long Range Dependence

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Jose Blanchet, Columbia University, Mudd Building 340, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Monte Carlo Methods for Ill-posed Inverse Problems
Rama Cont, Associate Professor, Columbia University, 500 W. 120th Street, New York, NY, 10027, Rama.Cont@columbia.edu

Ill-posed inverse problems arising in parameter estimation from noisy observations are usually tackled with deterministic optimization methods, ignoring non-uniqueness of solutions which reflects parameter uncertainty. We present a Monte Carlo method which generates a random sample of solutions for a large class of nonlinear ill-posed inverse problems. We exhibit conditions under which the algorithm generates an IID sample of solutions, which can be used to analyze parameter uncertainty.

2 - Strongly Efficient Simulation of Light Tailed Sums
Kevin Leder, kevinleder@gmail.com

We estimate the probability that the average of a large number of light-tailed mean zero i.i.d. random vectors does not lie in a closed convex set that does not contain the origin. We provide a state-dependent importance sampling that has bounded coefficient of variation. Our change of measure is obtained by computing the optimal tilting at each step, which corresponds to the solution of the Isaacs equation studied recently by Dupuis and Wang (2004).

3 - Efficient Large Buffer Estimation of General Gaussian Queues
Jose Blanchet, Columbia University, Mudd Building 340, New York, NY, United States of America, jose.blanchet@columbia.edu

We consider estimating the tail of the maximum of a Gaussian process with negative drift via simulation. We discuss an algorithm that requires a polynomial (in the tail parameter) number of function evaluations to estimate such tail probability within a given prescribed relative accuracy. Our procedure is very simple and its performance is theoretically guaranteed for arbitrary dependence structures.

■ MB28

H-Room 500, Fifth Floor

Decentralized Pricing and Alliances in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Gustavo Vulcano, Assistant Professor, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu

1 - Airline Alliance Collaboration and Operation
Xing Hu, PhD Candidate, New York University, 44 West 4th St, New York, NY, 10012, United States of America, xhu@stern.nyu.edu, Rene Caldentey, Gustavo Vulcano

We investigate contractual agreements between multiple airlines operating within a network alliance. We study contracts that specify how revenue should be split among the carriers. We propose a two-step hierarchical approach. First, we formulate a static problem in which airlines select partitioned allocations and show that a simple transfer price mechanism achieves first best. Then, we study the dynamic problem and prove that the static transfer prices are asymptotically optimal.

2 - Airline Alliance Revenue Management Using a Deterministic LP Formulation
Sandra Transchel, Smeal College of Business, 461 Business Building, University Park, PA, 16802, United States of America, sxt37@psu.edu, Robert Shumsky

We examine the airline alliance revenue management problem using a formulation based upon the deterministic linear programming model for network revenue management. We identify transfer prices for interline itineraries that are system-optimal. We also explore the airlines' equilibrium policies and compare the overall performance to an alliance with centralized control.

3 - Designing Fair Allocations for Carrier Alliances
Lori Houghtalen, Assistant Professor of Operations Research, Babson College, Division of Mathematics and Science, Babson Park, MA, 02457, United States of America, lhoughtalen@babson.edu, Ozlem Ergun, Joel Sokol

Given a mechanism that encourages alliance-optimal behavior from carriers, we focus on directing the mechanism toward resource prices that lead to fair allocation of revenue. Fairness measures explored include equal distribution of benefit and measures based on the value of cargo and capacity carriers contribute. Equal benefit distribution leads to more alliance revenue overall, but the mechanism is able to achieve allocations more precisely when fairness is measured by the value of a carrier.

4 - Decentralized Control of a Stochastic Pricing-service System
Andrew Lim, Associate Professor, University of California (Berkeley), IEOR Department, 4177 Etcheverry Hall, University of California, Berkeley, CA, 94720-1777, United States of America, lim@ieor.berkeley.edu, Peng Li, J. George Shanthikumar

We formulate a stochastic system where arrivals and service rate are controlled. We show how to decouple this system into a single period revenue management problem and a service rate control problem. We show how to centralized optimal can be computed without pricing and service agents sharing demand rate and objective function information.

■ MB29

H-Room 501, Fifth Floor

Issues in Generation Expansion Planning and Environmental Policy Modeling

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Vishnu Nanduri, Assistant Professor, Department of Industrial & Manufacturing Engineering, University of Wisconsin Milwaukee, 3200 N Cramer Street, Milwaukee, WI, 53211, United States of America, nvishnuteja@gmail.com

1 - Generation Capacity Expansion in Restructured Power Markets under a CO2 Cap-and-Trade Program
Patricio Rocha, University of South Florida, Department of Industrial Eng, Tampa, United States of America, procha@mail.usf.edu, Vishnu Nanduri, Tapas Das

Power generators face the challenge of determining where, when and what type of power plant to build to satisfy an increasing demand. The potential implementation of a CO2 cap-and-trade program is likely to compound this challenge. In this paper, we develop a model to obtain generation capacity expansion plans in restructured markets under different CO2 cap-and-trade scenarios. A real-life application to the Illinois Electricity Market is presented.

2 - Renewable Subsidy Policy Design for Generation Expansion
Lizhi Wang, Assistant Professor, Iowa State University, Industrial and Manufacturing Systems Eng, Ames, IA, 50014, United States of America, lzwang@iastate.edu

We use an inverse optimization approach to design the most cost effective subsidy policy to promote renewable energy in a generation expansion planning problem. The subsidy policy is designed to achieve (1) sufficient generation to accommodate load increase, (2) an increased renewable energy portfolio, and (3) lower and more stable electricity prices.

3 - Renewable Energy in Generation Expansion Planning Models
Jianhui Wang, Computational Engineer - Energy Systems, Argonne National Laboratory, 9700 S. Cass Ave, Bldg. 900, Argonne, IL, 60439, United States of America, jianhui.wang@anl.gov, Audun Botterud, Vladimir Koritarov, Thomas D. Veselka

Traditionally, renewable energy like wind and solar power has received limited attention in generation expansion planning. However, investments in these technologies are rapidly increasing due to policies aiming at reducing carbon emissions and increasing the share of renewable energy. We discuss how the uncertainty and variability in renewable energy can be represented in generation expansion planning, with focus on the rapid expansion of wind power.

4 - The Ambiguous Effect of Contracts on Competition and Prices in Restructured Electricity Markets
Fred Murphy, Professor, Temple University, Philadelphia, PA, 19122, United States of America, fmurphy@temple.edu, Yves Smeers

We construct a stylized model of contracts where two firms, each specializing in some technology, invest in a first stage, contract part of their production in the second stage and sell the rest in the spot market in the third stage. We find both the incentive to contract to foreclose the market and a reduction in pricing power. The outcome of including contracts can lead to either increases or decreases in capacity and peak prices and contracts are not a guaranteed solution to market power.

■ MB30

H-Room 502, Fifth Floor

Forestry IV: Urban Forest Management

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Urban Trees: The Antidote to Broken Windows?
Geoffrey Donovan, U.S. Forest Service, Pacific Northwest Research Station, Portland, OR, United States of America, gdonovan@fs.fed.us, Jeffrey Prestemon

Research has shown that urban trees provide a range of benefits including reducing heating and cooling costs and increasing property values. Less attention has been focused on the potential of urban trees to affect crime occurrence. We present evidence that non view-obstructing trees reduce crime, because they signal that a house is well cared for. This is consistent with the broken-window hypothesis, which suggests that if a neighborhood does not appear cared for, then it will attract crime.

2 - Simulating the Energy Savings From Shade Tree Plantings
David Butry, National Institute of Standards and Technology, Gaithersburg, MD, United States of America, david.butry@nist.gov, Geoffrey Donovan, Joshua Kneifel

While planting shade trees reduces residential cooling costs, it may not be cost-effective when compared to other energy saving measures. Using EnergyPlus, we compare the residential energy savings produced by urban shade tree plantings with those more traditional methods of achieving energy efficiency (e.g., windows, insulation, HVAC replacement). We find the savings produced by shade trees to be substantial, with optimal tree placement depending on tree characteristics and house orientation.

3 - Cost of Potential Emerald Ash Borer Damage in U.S. Communities, 2009-2019
Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us, Andrew Liebhold, Rodrigo Mercader, Nathan Siegert, Deborah McCullough, Kent Kovacs

Emerald ash borer, a beetle native to Asia, was discovered near Detroit in 2002 and by 2009 had been found in 10 other states. EAB is a highly invasive forest pest that has the potential to spread and kill native ash trees throughout the U.S. Using a simulation model of EAB spread, we estimate the impacts of EAB in urban areas in a 25-state region. We predict that 17 million ash trees will be treated or removed over the next decade with discounted cost of $9.9 billion.

■ MB31

H-Room 503, Fifth Floor

Learning/Robust Methods for Pricing and Capacity Control

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Tatsiana Levina, Queens School of Business, 143 Union Street, Kingston, Canada, tlevin@business.queensu.ca

1 - Data-driven Learning for a Class of Stochastic Optimization Problems

Soonhui Lee, PhD Candidate, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, soonhui@u.northwestern.edu, J. George Shanthikumar, Tito Homem-de-Mello

We discuss stochastic optimization problems that involve unknown dependencies between the decision and the random variables in the model. An important case occurs in the setting where demand depends on the inventory controls such as order quantities. We study a data-driven learning algorithm that simultaneously learns the objective function from previous observations and optimizes the obtained estimates. We present examples and discuss convergence properties of the algorithm.

2 - Risk Premiums in the Newsvendor Model

Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States of America, guillaume.roels@anderson.ucla.edu

In this talk, we quantify the value of information associated with demand uncertainty in the price-setting newsvendor model. We present a unifying framework that generalizes the additive and the multiplicative demand models and we quantify the worst-case magnitude of the price risk premiums resulting from demand uncertainty.

3 - Symbolic Perseus: a Generic POMDP Algorithm with Application to Dynamic Pricing with Demand Learning

Pascal Poupart, Associate Professor, School of Computer Science, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, ppoupart@cs.uwaterloo.ca

Partially Observable Markov Decision Processes (POMDPs) provide a flexible framework for dynamic pricing with demand learning. Given the wide range of applications, there is a need for scalable algorithms that can optimize the policies of arbitrary POMDPs. I will describe Symbolic Perseus, a publicly available POMDP package, that has been used to optimize discrete factored POMDPs with millions of states. The algorithm will be illustrated with various applications including dynamic pricing.

4 - Aggregating Algorithm for Pricing and Capacity Planning under Uncertain Demand

Tatsiana Levina, Queens School of Business, 143 Union Street, Kingston, Canada, tlevin@business.queensu.ca, Yuri Levin, Mikhail Nediak, Jeff McGill, Vladimir Vovk

We study the problem of pricing and stocking of perishable items when demand and the reservation price distributions are unknown. The company learns consumer demand through successive observations over consecutive planning horizons, views the problem as a game against nature and applies Aggregating Algorithm to find the policies which are asymptotically optimal in the long run. The proposed methodology is general and independent of the form of the distributions.

■ MB32

H-Room 504, Fifth Level

Stochastics in Finance

Cluster: Financial Engineering
Invited Session

Chair: Ruth WilliamsProfessor, University of California, San Diego, Dept of Mathematics, 9500 Gilman Drive, La Jolla, CA, 92093-0112, United States of America, williams@stochastic.ucsd.edu

1 - A Fast Mean-reverting Correction to Heston's Stochastic Volatility Model

Matthew Lorig, Ph.D. Student, UCSB, Statistics and Applied Probability, South Hall, Santa Barbara, CA, 93, United States of America, mattlorig@gmail.com, Jean-Pierre Fouque

We propose a multi-scale stochastic volatility model in which a fast mean-reverting factor of volatility is built on top of the Heston stochastic volatility model. A singular pertubative expansion is then used to obtain an approximation for European option prices. Numerical difficulties are discussed, and techniques for avoiding these difficulties are provided. Our results are illustrated numerically and with option data.

2 - Correlated Intensity, Counter Party Risks, and Dependent Mortalities

Jin Ma, Professor, University of Southern California, Department of Mathematics, 3620 S. Vermont Ave. KAP 108, Los Angeles, CA, 90089, United States of America, jinma@usc.edu

We propose an intensity-based approach for studying the correlated default probability. Based on an idea of Collins-Dufresne et al., we derive a representation theorem for joint survival probability. The representation theorem works particularly well for certain counter-party risk models and dependent mortality models for married couples. Other topics include the study of first and last to default probabilities in a multi-firm setting, in particular the phenomenon of "flight to quality".

3 - Connecting Singular Controls and Switching Controls, with Applications to Irreversible Investment

Xin Guo, Associate Professor, UC at Berkeley, Berkeley, United States of America, xinguo@newton.berkeley.edu

It was well known that a certain class of singular control problems is connected to optimal stopping problems. In this talk, we present a new theoretical connection between singular control of finite variation and optimal switching problems. This correspondence provides a novel method for solving explicitly multi-dimensional singular control problems, and links singular controls and Dynkin games through sequential optimal stopping. This is a joint work with P. Tomecek, JP Morgan.

4 - Credit Risk Modeling with Misreporting and Incomplete Information

Agostino Capponi, PhD, California Institute of Technology, Paadena, CA, 91125, acapponi@caltech.edu, Jaksa Cvitanic

We propose a structural model for the valuation of defaultable securities of a firm which models the effect of deliberate misreporting done by insiders in the firm and unobserved by others. We derive formulas for corporate securities and default measures under the proposed credit risk framework. We propose a novel estimation approach to structural model estimation which accounts for noisy observed asset values and apply it to the concrete case of Parmalat.

■ MB33

H-Room 505, Fifth Floor

Retail Supply Chain Management

Cluster: Economic Models in Operations Management
Invited Session

Chair: Naren Agrawal, Santa Clara University, The Leavey School of Business, 500 El Camino Real, Santa Clara, CA, 95053, NAgrawal@scu.edu

1 - Price Markdown Optimization for a Fast-Fashion Retail Network

Felipe Caro, Assistant Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, fcaro@anderson.ucla.edu, Jeremie Gallien

In collaboration with Spanish retailer Zara, we address the problem of deciding the price markdowns during clearance sales. We approached the pricing problem by formulating two models, one to forecast demand, and the other to optimize the markdown decisions with a finite horizon in mind. We describe the results of a controlled field experiment conducted in all Zara stores in Belgium and Ireland during the winter clearance sales of 2008/09 in order to test the optimization-based pricing model.

2 - Empirical Study of Retail Execution

Nicole DeHoratius, University of Portland Pamplin School of Business, Zaragoza Logistics Center, Portland, United States of America, dehorati@up.edu, Marshall Fisher, Serguei Netessine

We describe research with a fast food restaurant chain that uses perating data, customer satisfaction survey results and in stock mystery shopping to identify drivers of sales and satisfaction. Particular attention is paid to the design of the restaurant process. This is part of a larger project with a number of retailers that aims to identify store operating policies that result in outstanding store execution, customer experience and financial performance.

3 - The Effect of Waiting Time on Customer Purchases: An Empirical Study

Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, 10027, United States of America, molivares@columbia.edu

This paper studies empirically how customer delays in a supermarket affect customer purchases. We collected data on queue lenghts using videocameras and image recognition. These data were matched with point-of-sale data to estimate the effect of expected delays on sales. We also provide some insights on how these results can be used to optimize staffing decisions.

4 - Optimizing Prepacks for Retail Supply Chains
Stephen Smith, Professor, Santa Clara University, Lucas Hall 216H, 500 El Camino Real, Santa Clara, CA, 95053-0382, United States of America, Ssmith@scu.edu

Retail supply chain managers frequently bundle several units of the same item, or combinations of multiple items, into various "prepack" to reduce shipping and handling costs. The paper discusses heuristics and formulates a mixed integer LP for designing an optimal set of prepacks for periodic replenishments with discrete demands. Illustrative computational results are presented.

■ MB34

H-Room 520, Fifth Floor

Joint Session OR-Societal Impact/TSL: Logistics in Large-Scale Disaster

Cluster: OR/MS with Societal/ Humanitarian Impact & Transportation Science and Logistics
Invited Session

Chair: Elise Miller-Hooks, Associate Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, elisemh@umd.edu

1 - A Dynamic Relief Demand Forecast Model for Emergency Logistics Operations in Large-Scale Disasters
Jiuh-Biing Sheu, Professor and Director, National Chiao Tung University, 4F,no.114,Sec.1,Chung Hsiao W. Road, Taipei, 10012, Taiwan - ROC, jbsheu@mail.nctu.edu.tw

This paper presents a dynamic relief demand forecast model which involves three recursive mechanisms for emergency logistics operations under large-scale disasters. The proposed methodology utilizes the techniques of data fusion, fuzzy-clustering, and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). The results of numerical studies with simulation data indicate the applicability of the proposed method and its potential advantages.

2 - Optimal Ordering and Issuing Policies for Perishable Inventory System with Minimum Volume Constraint
Yen-Ming Lee, University of Southern California, 3715 McClintock Ave, GER 240, Department of Industrial & Systems Engineerin, Los Angeles, 90089-0193, United States of America, yenmingl@usc.edu, Shi Mu, Zhihong Shen, Maged Dessouky

SNS is part of the federal response to a large-scale emergency in the United States. The SNS is currently divided into "Push Packages" directly managed by the government, which constitute about 20%, with the rest as VMIs. We present perishable inventory system that enables the VMI suppliers to meet their minimum inventory requirement while maximizing their profit.

3 - Inventory Policies for Humanitarian Aid During Hurricanes
Laura Consuelos Salas, Research Assistant, ITESM Campus Toluca, Eduardo Monroy # 2000, San Antonio Buenavista, Toluca, Estado de México, 50110, Mexico, lconsuel@asu.edu, Muhong Zhang, Manuel Robles Cardenas

The work includes a methodology to calculate the demand for shelters in case of hurricane wind impact. It is based in physical vulnerability of houses and the time to stay in shelter. The MIP to determine the inventory policy that best satisfies that demand, is based in the newsboy model and transforms it to a deterministic problem using conditional expectation.

4 - Managing Supply Chains in Times of Crisis: A Review of Literature and Insights
Malini Natarajarathinam, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, malini@entc.tamu.edu, Ismail Capar, Arunachalam Narayanan

The objectives of this study are to provide a framework for classifying supply chain management literature in crisis management and to identify current and future research directions in this field. In addition, this paper will not only be a resource to academicians but also to practitioners who are looking for best practices in academic literature for managing disruptions in supply chains.

■ MB35

H-Sapphire A, Fourth Floor

Patient Management - Scheduling II

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - A Two-phase Multiobjective Approach for Operating Room Planning and Scheduling Problem
Qing Li, PhD Student, Arizona State University, ISOE Department, P.O. Box 875906, Tempe, AZ, 85287-5906, United States of America, qli30@asu.edu, John Fowler

In this study, we develop an approach for cyclic block scheduling as well as day-to-day patient scheduling in operating rooms (OR), with the objectives of reducing staff overtime, idle time and patient waiting time. The problem is formulated in mixed integer programming and solved with CPLEX. A Random Keys Genetic Algorithm is used in patient sequencing to find the Pareto optimal sequence on the day of surgery.

2 - Approximate Dynamic Programming (ADP) for Resource-constrained Project Scheduling Problems
Yasin Gocgun, Doctoral Student, Industrial and Systems Engineering, University of Washington, Box 352650, Seattle, WA, 98105, United States of America, gocgun@u.washington.edu, Archis Ghate

We discuss models and algorithms for a class of stochastic, dynamic, resource-constrained scheduling problems. These problems can be formulated as infinite horizon Markov Decision Processes (MDPs). We approximately solve these MDP formulations using mathematical programming-based ADP techniques and compare their performance with heuristic policies. We also present applications from healthcare focusing on multi-category patient scheduling problems in an urban, diagnostic facility.

■ MB36

H-Sapphire B, Fourth Floor

2009 Pierskalla Competition Papers I

Sponsor: Health Applications
Sponsored Session

Chair: Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

1 - At What Lipid-ratios Should a Patient with Type 2 Diabetes Initiate Statins?
Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Nilay Shah, Steven Smith, Andrew Schaefer, Brian Denton

Lipid abnormalities elevate the risks of coronary heart disease (CHD) and stroke for patients with Type 2 diabetes and can be treated by statins with adverse side effects. We formulate the optimal timing of statin initiation problem as an infinite-horizon Markov decision process and explore several structural properties of the resulting treatment policies. We analyze the sensitivity of these policies with respect to varying risk factors and present computational results based on clinical data.

2 - The Benefit of Pooling Operating Rooms under Uncertainty
Sakine Batun, University of Pittsburgh, Pittsburgh, PA, 15260, sab79@pitt.edu, Andrew Schaefer, Todd R. Huschka, Brian Denton

We study the problem of scheduling surgeries with uncertain durations in a multiple operating room (OR) environment. We formulate the problem as a two-stage stochastic mixed integer program (SMIP) with the objective of minimizing total expected operating cost. We analyze structural properties of our model and propose a way of improving the existing solution procedures by adding valid inequalities to the formulation. We perform computational experiments based on real data.

3 - A Broader View of Designing the Liver Allocation System
Fatih Safa Erenay, University of Wisconsin Madison, 501 N Midvale Blvd Apt C, Madison, WI, 53705, United States of America, erenay@wisc.edu, Adnan Said, Mustafa Akan, Baris Ata, Oguzhan Alagoz

We develop a more efficient liver allocation system using a fluid model that minimizes a weighted sum of total quality adjusted life years and number of patient deaths while waiting for transplant. Our model considers the disease evolution as well as patient preferences. The proposed system allocates the livers to the patients who have the highest marginal benefit from transplant. We also simulate the current and proposed liver allocation systems using clinical data for comparison.

4 - The Search for Compatible Kidneys for Transplantation - A Handy Research and Decision Aid
Israel David, Professor, Ben-Gurion University, 14/38 Rahavat-Ilan Street, Givat-Shmuel, Israel, idavid@bgu.ac.il

We study the prospects of patients for kidney transplant and their optimal acceptance-rejection policy for varying-quality tissue matching. We present a computational tool to calculate the probabilities of present-day relevant HLA

mismatches, and the optimal policy in terms of critical times. The accompanied Excel software may serve both the surgeon and the organizer of a donation program. Its use sheds light on debated issues such as race discrimination in unrelated-donor organ transplantation.

■ MB37

H-Sapphire C, Fourth Floor

Contracts and Incentives in Supply Chains

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, Terman Enineering Center, Room 305, Stanford, CA, 94305, United States of America, ferhun@stanford.edu

1 - Optimal Pricing for Platform Products with Service Subscription
Hugo Mora, PhD Student, Stanford University, 344 Olmsted Rd, Apt 144, Stanford, 94305, United States of America, hrmora@stanford.edu, Juan Carlos Ferrer

We study the pricing decision of a firm that provides a subscription to a bundle consisting of a platform product and its associated service. The pricing policy consists of: the product price in the first period and the per-period subscription price. We show that the optimal product price is increasing in the product cost. The optimal subscription price depends on the service cost, but is independent of the product price and cost.

2 - A Dual-source Tool Capacity Expansion Problem with Reservation and Demand Forecast Updates
Chen Peng, PhD Candidate, Stanford University, Terman Engineering Center, RM 377, 380 Panama Way, Stanford, CA, 94305, United States of America, chenpeng@stanford.edu, Feryal Erhun

We study a dual-source tool capacity expansion problem with consecutive supply lead times under demand forecast updates. We show that fast orders follow a state-dependent base-stock policy. However, different from the inventory results, the slow orders do not necessarily have a base-stock policy, which shows that tool capacity expansion problem is more complex than its inventory counterpart. We characterize the conditions under which dual sourcing is beneficial to the buyer.

3 - The Impact of Environmental Regulations on Global vs. Local Product Sourcing Decisions
Daniel Greenia, Stanford, 375 Terman Hall, Stanford, CA, 94305, United States of America, dgreenia@stanford.edu, Dariush Rafinejad

We create a dynamic economic model of an industry that sources from either an environmentally unregulated, low cost region or a regulated, expensive region. Unlike traditional supply chain models, we explicitly account for environmental degradation with decreased labor productivity and by imposing increasingly strict regulations as pollution accumulates. Within this framework we study the impact of environmental regulations on the industry's financial performance, in addition to public health.

■ MB38

H-Sapphire D, Fourth Floor

Recent Advances in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Saibal Ray, Associate Professor, Desautels Fac of Mgmt, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, saibal.ray@mcgill.ca

Co-Chair: Tim Huh, Columbia University, 500 West 120th St, New York, United States of America, th2113@columbia.edu

1 - Lost-sales Inventory Models with Batch Ordering and Handling Costs
Jan Fransoo, Professor, Eindhoven University of Technology, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, J.C.Fransoo@tue.nl, Alina Curseu, Tom Van Woensel, Nesim Erkip

We consider the inventory control of a single item facing stochastic demand under periodical review, a fixed batch size, and lost sales. The replenishment cost include a fixed, as well as a linear component, depending on the number of batches and the number of units in the order. This structure captures the shelf-stacking costs in retail stores and allows economies of scale. We analyze the structure of the optimal policy, provide a numerical analysis, and introduce an effective heuristic.

2 - How Good Are (s,S) and (r,nQ) Policies in Two-Stage Serial Supply Chains?
Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. Geroge Street, Toronto, ON, M5S3E6, Canada, ming.hu@rotman.utoronto.ca, Lifeng Chen

We consider the classical two-stage serial supply chain with Poisson demand, fixed ordering costs and fixed transportation lead times. We show that there exist (s,S) and (r,nQ) policies whose long-run average costs are less than 2.25 times the optimal cost. We further show that these policies are asymptotically optimal as the ratio, between the optimal ordering quantities for the downstream and upstream stage when the system is relaxed to two single-stage problems, decreases to zero.

3 - Inventory Control with Outsourced Logistics
Osman Engin Alper, University of California, Berkeley, IEOR Department, Berkeley, United States of America, engin@ieor.berkeley.edu, Hyun-soo Ahn, Phil Kaminsky

As logistics outsourcing becomes more prevalent, managers need efficient strategies for managing inventory in the presence of a wide variety of different logistics contracts and strategies. Motivated by this, we analyze inventory control problems in systems with different logistics outsourcing strategies, characterize optimal policies, provide computational results, and summarize practical implications.

4 - Optimal Lot-sizing Policy For a Warm/Cold Process With Stochastic Demand and Lost Sale
Yi Yang, PhD Student, Chinese Univ of HK, PGH 2, The Chinses University of HongKong, HK, Hong Kong - PRC, yangyi@se.cuhk.edu.hk, Youhua Chen

We analyze a periodic-review production-inventory system in which at the beginning of each period, the process is in one of the two states: warm and cold, which depend on the production quantity of the previous period. Beginning with a warm (cold) state, production in the current period will incur no fixed (a fixed) setup cost. We establish theoretical results on the structure of the optimal production/inventory policy and propose an efficient heuristic policy.

■ MB39

H-Sapphire E, Fourth Floor

Sustainable Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Baris Ata, Professor, Northwestern University, MEDS Dept - Kellogg School of Management, 2001 Sheridan Road, Evanston, ID, 60208, b-ata@kellogg.northwestern.edu

Co-Chair: Deishin Lee, Professor, HBS, Soldier's Field Rd, Morgan 415, Boston, MA, 02163, United States of America, dlee@hbs.edu

1 - Is Leasing Greener Than Selling?
Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, 30308, United States of America, vishal.agrawal@mgt.gatech.edu, Mark Ferguson, Beril Toktay, Valerie Thomas

There are claims that leasing is environmentally superior as a firm retains ownership of the off-lease units, it has an incentive to remarket the products, resulting in a lower production and disposal volume. However, it may be worse since the firm may prematurely dispose them to avoid cannibalization. In this paper, we analytically investigate if either leasing or selling can be both more profitable and have a lower environmental impact.

2 - The ESCO Problem under Uncertainty
Paul Kleindorfer, Professor, INSEAD, Blvd de Constance, Fontainebleau, 77305, France, Paul.Kleindorfer@INSEAD.edu, Sam Aflaki

An Energy Service Company (ESCO) implements energy efficiency projects for customers, which generates positive cash flows from the energy and carbon savings resulting from the project. For ESCO-type projects, we characterize Pareto efficient contracts having the following structure: upfront investment shares, ex-post profit shares and an ex-ante guarantee by the ESCO of savings for the customer. A case study from the pharmaceutical industry is used to illustrate the concepts and results.

3 - CO2 Emission Regulations and Electricity Prices: The Case of Coal-Fired Power Plants

Ozge Islegen, PhD Candidate, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States of America, oislegen@stanford.edu, Stefan Reichelstein

This study projects the changes in electricity prices if coal-fired power plants are regulated for their CO2 emissions. We focus on carbon capture and storage (CCS) technology that new power plants may adopt either because of a mandate or because the market price of CO2 emission permits is sufficiently high. We forecast the resulting changes in wholesale electricity prices and identify the break-even price of CO2 emission permits that makes the adoption of CCS technology economically attractive.

4 - Optimization of a Waste-to-Energy Operation

Deishin Lee, Professor, HBS, Soldier's Field Rd, Morgan 415, Boston, MA, 02163, United States of America, dlee@hbs.edu, Mustafa Tongarlak, Baris Ata

We study a firm that converts organic waste into energy using an anaerobic digestion process. We derive the profit-maximizing operational and pricing strategies for the firm. Given the operational model, we consider how different regulatory mechanisms can affect the strategy of the firm and the associated environmental implications.

■ MB40

H-Sapphire H, Fourth Floor

Financial Optimization, Account Management and Retail Credit Risk Management

Sponsor: Financial Services
Sponsored Session

Chair: Adrian Becker, MIT Operations Research Center, 77 Massachusetts Ave, Bldg E40-135, Cambridge, MA, 02139, United States of America, adrianbb@mit.edu

1 - Optimal Spending Patterns and Asset Allocation for Endowments, Foundations and Individuals

Chaithanya Bandi, Graduate Student, MIT, 550 Memorial Drive, Apt:10D-2, Cambridge, MA, 02139, United States of America, cbandi@mit.edu, Dimitris Bertsimas

We propose the application of Stochastic Dynamic Programming(SDP) and Robust Optimization methodologies to obtain optimal spending and investing policies in conjunction with eachother. We present tractable approaches to capture different levels of risk-aversion and different priorities of a manager. The policies obtained are compared with policies used presently and significant improvements are observed.

2 - Voice and Conscience for Optimization in Financial Planning

Adrian Becker, MIT Operations Research Center, 77 Massachusetts Ave, Bldg E40-135, Cambridge, MA, 02139, United States of America, adrianbb@mit.edu, Dimitris Bertsimas

We discuss two product additions developed for the Ameriprise Lifetime Optimizer. Voice translates proofs of local optimality into natural language giving intution as to why a client should adopt the proposed solution. Conscience identifies instances where model simplifications introduced for tractability yield a mathematically optimal solution which would perform sub-optimally when exposed to real-world dynamics. Cutting planes are then added to the underlying MIP to avoid this situation.

3 - Modeling the Credit Risk of RMBS; Comparison of Models

Lyn Thomas, Professor, University of Southampton, School of Management, University of Southampton, Southampton, So17 1BJ, United Kingdom, L.Thomas@soton.ac.uk

One cause of the credit crunch, according to the Securities and Exchange Commission was the inability of the rating agency models to correctly assess the credit risk of residential backed mortgage. This is partly because models based on corporate credit risk were used. This talk compares the different models based on consumers' behavioural scores used to estimate the credit risk of portfolios of consumer loans and suggests how these deal with difficulties identified in existing models.

4 - Integrating Loss Mitigation Decisioning Into Distressed Mortgage Valuation

Jim Bander, VP, Solution Management & Research, Response Analytics, Inc., 7426 E Stetson Dr., Suite 120, Scottsdale, AZ, 85251, United States of America, Jim.Bander@gmail.com

Investors in portfolios of distressed mortgages have to determine the portfolio value. We describe a methodology for doing so while evaluating every loan in the portfolio under each of several possible loss mitigation treatments, and determining an optimal loss mitigation policy subject to treatment eligibility and capacity constraints.

■ MB41

H-Sapphire L, Fourth Floor

JFIG Paper Competition II

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Ananth Iyer, Purdue University, aiyer@purdue.edu

1 - Quality Speed Conundrum: Trade-offs in Customer-Intensive Services

Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu

We model services where the expected service quality changes with service speed. Increasing the service rate reduces the waiting costs, but also reduces the expected service quality. An arriving customer decides whether to join a service based on its value, speed of service and his expected waiting costs. In equilibrium, when a service is more customer-intensive, the service provider chooses to slow down. We find that firms select partial coverage of the market, and charge higher prices in competition.

2 - Revenue and Cost Management for Remanufactured Products

Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, aovchinnikov@darden.virginia.edu

I present a model of firm's remanufacturing operations and a behavioral study that estimates its key element - a function that describes the fraction of consumers who switch from new to refurbished product. The behavioral study shows that this function has an inverted-U shape and hence cannot be modeled using the popular WTP-based approach. I then solve the model for both the inverted-U and WTP-based behaviors and comment on how firm's policy changes.

3 - The Linear Programming Approach to Solving Large Scale Dynamic Oligopoly Models

Vivek Farias, Assistant Professor, MIT Sloan School, E53-317, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, vivekf@mit.edu, Denis Saure, Gabriel Weintraub

Dynamic oligopoly models are used in industrial organization and the management sciences to analyze diverse dynamic phenomena. The computational complexity of solving for the equilibrium has severely limited the applicability of these models. We introduce approximation methods based on the LP approach to approximate dynamic programming that dramatically reduce the computational complexity. Our methods greatly increase the set of dynamic oligopoly models that can be analyzed computationally.

■ MB42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS
Invited Session

Chair: Allen Butler, President, Daniel H Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Approximate Dynamic Programming Captures Fleet Operations for Schneider National

Hugo Simao, Research Staff, Princeton University - CASTLE Lab, Sherrerd Hall 112, Princeton, NJ, 08544, United States of America, hpsimao@princeton.edu, John Nienow, Abraham George, Warren Powell, Jeff Day, Ted Gifford

Schneider National needed a model that would replicate the behavior of their team of dispatchers. We used the modeling and algorithmic framework of approximate dynamic programming to optimize the movements of 6,000 drivers, each described by a 15 dimensional attribute vector, over a month. The model closely replicates historical performance, and also produces accurate estimates of the marginal value of each of 500 types of drivers. Numerous projects have produced millions in savings.

2 - A Queuing Model-Based System for Semiconductor Production Planning at IBM

Horst Zisgen, IBM Deutschland Research and Development GmbH, Hechtsheimer Strasse 2, Mainz, 55131, Germany, horst_zisgen@de.ibm.com, Steven M. Brown, Ingo Meents, Thomas Hanschke, Benjamin R. Wheeler

This paper presents IBM's Enterprise Production planning Optimization System (EPOS). EPOS uses a unique queuing network model combined with linear

programming to meet the requirements of capacity and lead time planning for semiconductor manufacturing. EPOS is in continuous use at IBM's 300mm factory where it has become an integral tool for predicting bottlenecks, prioritizing continuous improvement efforts, planning capital investment, and managing factory lead times. EPOS has guided efforts to improve factory performance and reduce more than 30 million dollars of expense.

■ MB43

H-Room 400, Fourth Floor

Operations Management and Marketing

Cluster: Supply Chain Models
Invited Session

Chair: Xuanming Su, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

1 - Advanced Booking Programs for Managing Supply, Demand, and Price Risks in a Two-Level Supply Chain
Soo-Haeng Cho, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, Pa, 15213, United States of America, soohaeng@andrew.cmu.edu, Christopher S. Tang

While advance booking programs have been shown to be effective for manufacturers to meet uncertain demand, it is unclear if advance booking will be effective when supply, demand, and market price risks are present in a supply chain. Motivated by an advance booking program for managing these three types of risks arising in a flu vaccine supply chain, we present a two-stage Stackelberg game model to examine the dynamic interactions between the manufacturer and the retailer.

2 - Consumer Learning, Word of Mouth, and Quality Competition
Vishal Gaur, Associate Professor, Johnson School, Cornell University, vg77@cornell.edu, Young-Hoon Park, Chang Hee Park

In a competitive market, consumers are not well informed about the service levels offered by firms. Instead, they choose among firms based on past experience. Thus, the mean and volatility of demand faced by a firm become functions of the service levels provided by all firms in the marketplace. We analyze this phenomenon, and show how firms may encourage word-of-mouth to mitigate or exacerbate the effects of consumer learning.

3 - Managing Seasonal Queues with Strategic Buyers
Steven Shugan, Russell Berrie Eminent Scholar and Professor, University of Florida, 201 Bryan Hall Campus Box 117155, Gainesville, FL, 32611, United States of America, Steven.Shugan@cba.ufl.edu, Aydin Alptekinoglu

Seasonality creates predictable demand peaks during particular seasons, months, days, hours and so on. During these peaks (e.g., Christmas at Disney), strategic buyers sometimes expect greater congestion than during off-peak periods. Using queuing congestion models, we derive the best strategies for different types of seasonal peaks. We provide the logic and intuition underlying each strategy.

4 - Optimal Pricing with Speculators and Strategic Consumers
Xuanming Su, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

For limited-quantity items (e.g., tickets to sporting events, hot electronic gadgets), speculators who have no use for the product may make purchases purely with the intention of resale (e.g., over eBay). At the same time, consumers may strategically time their purchases. We study the seller's pricing problem in the presence of speculators and strategic consumers. We characterize equilibrium prices and profits and discuss model implications.

■ MB44

H-Room 402, Fourth Floor

Designing and Pricing Services

Sponsor: Service Science
Sponsored Session

Chair: Emmanuel Fragniere, Haute Ecole de Gestion, 7 Route de Drize, Carouge, Switzerland, emmanuel.fragniere@hesge.ch

1 - Knowledge Based Service Pricing : Modeling Barter Deals for Perceived Benefits Sharing
Francesco Moresino, HEG, 7 Route de Drize, Carouge, Switzerland, francesco.moresino@hesge.ch, Emmanuel Fragniere

Value added services involve human expertise from both producers and customers. In this context,the pricing scheme acts more like an organizer of the dynamic co-production process than a simple conventional "price tag". We explore modeling developments through dual mathematical programming.

2 - Taking Design Thinking and Phenomenology into Consideration for Enriching Innovation in Consultancy
Xavier Pavie, PhD candidate, Senior Researcher & lecturer, ESSEC Business School, 1 boulevard B. Hirsch, Cergy Pontoise, 95021, France, pavie@essec.fr

Facing a growth in complexity due to a series of reasons, providers of KIBS are looking for new and original ways to stimulate creativity and build relevant value-creating innovative solutions in response to the challenging questions they have to undertake. Based on an empirical study, the paper introduces KIBS issues, definition of Design and design thinking. Then, a new approach of Design Thinking articulated with philosophy to solve some KIBS's issues.

3 - Leveraging the Power of Architecture and Design in Innovative Services
Hervé Mathe, Professor, ESSEC, Boulevard BHirsch, Cergy Pontoise, France, hpmathe@yahoo.com

Organizational structures certainly are of great importance in order to determine employees'behaviour and performance. On the other hand, physical structures also significantly influence the way staff and customers view any company and interact with it. In service based activity firms and institutions are competing thanks to innovations in service portfolios, delivery processes, and management styles.

■ MB45

H-Room 410, Fouth Floor

A Deep-dive Session on Empirical NPD Research

Cluster: New Product Development
Invited Session

Chair: Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu

1 - Understanding the Dynamics of Contracting Regimes in Software Product Development Outsourcing
Sandra Slaughter, Professor of Information Technology Management and Alton M. Costley Chair, Georgia Tech College of Management, 800 W. Peachtree St. NW, Atlanta, GA, 30308, United States of America, sandra.slaughter@mgt.gatech.edu, Donald Harter, Soon Ang

This paper analyzes shifts in contracting regimes using longitudinal data on software development contracts between a software vendor and client over twenty years. Our results suggest that the changes in contracting regimes cannot be fully explained by standard explanations from contracting theory. We identify the factors that complement contractual governance in this setting.

2 - Using Networks to Evaluate Misalignment between a Design Organization and its Product Architecture
Wallace Hopp, Professor, University of Michigan, Ross School of Business, Ann Arbor, 48118, United States of America, whopp@umich.edu, Seyed Iravani, Bilal Gokpinar

We examine the vehicle development process of a large auto manufacturer. Using networks, we characterize vehicle architecture, formal communication patterns between design teams, and misalignments between the two. We show that these misalignments are positively correlated with warranty claims. Our results suggest that quality can be improved by better aligning organizational communication with product architecture and that social network analysis can be done without surveys.

■ MB46

H-Room 411, Fourth Floor

Models in Entrepreneurship

Sponsor: Technology Management
Sponsored Session

Chair: Moren Lévesque, Associate Professor, York University, Schulich School of Business, Toronto, ON, M3J 1P3, Canada, mlevesque@schulich.yorku.ca

1 - Resource Allocation Decision for the Internationalization of New Business Enterprise
Adeoye Adegorite, Graduate Student, University of Waterloo, Waterloo, ON, Canada, aiadegor@engmail.uwaterloo.ca

Many new business enterprises fail in the process of internationalizing. This is due, in part, to the challenges of allocating limited resources to sustain their local and international operations during and after internationalization. We formulate a decision model of resource allocation for the firm's local and foreign market activities. We characterize the resource allocation strategy that maximizes the firm's likelihood of survival during its internationalization process.

2 - Entrepreneurship and Regional Concentration
Graciela Kuechle, Lecturer, Witten/Herdecke University, Alfred-Herrhausen-Str.50, Witten, 58448, Germany, Graciela.Kuechle@uni-wh.de

This paper presents an evolutionary game theoretic model to show why regions may differ in terms of their levels of entrepreneurial activity even when they have similar economic potential, decisions are made simultaneously, there is migration between regions, and individuals are predisposed to imitate economically more successful agents. This model can give rise to a permanent different rate of entrepreneurship even when there is a considerable exchange among regions.

3 - Optimal Leader-Follower Strategies for Launching New Technologically-Advanced Products
John Angelis, Rochester Institute of Technology, E Philip Saunders College of Business, 105 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, jangelis@saunders.rit.edu

When launching a new, technologically-advanced product, a firm sets price and quality to maximize profits by attracting customers. However, its optimal decisions also depend on the level of innovation in customer segments and whether it is the first mover. We analyze a closed-loop Stacklberg game with perfect information. A firm will not necessarily earn more by being the first mover, and a firm with relatively high costs should target less innovative customer segments.

4 - Do IPOs Balance Innovation Against Growth?
Moren Lévesque, Associate Professor, York University, Schulich School of Business, Toronto, ON, M3J 1P3, Canada, mlevesque@schulich.yorku.ca, Nitin Joglekar, Jane Davies

Do post-IPO firms foster growth and profitability by making balanced investments in marketing and R&D, when compared with a matched sample of established firms? We specify a model of balanced growth at the firm level and test its implications for matched pairs of IPO and established firms in four industries.

■ MB47

H-Room 412, Fourth Floor

Tutorial: OR/MS Challenges in Healthcare Informatics

Cluster: Tutorials
Invited Session

Chair: Rema Padman, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, rpadman@andrew.cmu.edu

1 - OR/MS Challenges in Healthcare Informatics
Rema Padman, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, rpadman@andrew.cmu.edu

Healthcare Informatics has emerged as an exciting, multi-disciplinary research area aimed at improving the quality and safety of patient care at reduced cost using information and decision technologies. We present an overview of a variety of challenging problems arising at the interface of healthcare, information technology and the management sciences.

■ MB48

H-Sapphire Green Room, Fourth

Panel Discussion: Service Operations in an Economic Downturn

Cluster: Service Operations Management
Invited Session

Chair: Xin (David) Ding, Assistant Professor, University of Houston, T2-230C, Technology II Building, Houston, TX, 77204, United States of America, xding@Central.UH.EDU

1 - Service Operations in an Economic Downturn
Moderator: Xin (David) Ding, Assistant Professor, University of Houston, T2-230C, Technology II Building, Houston, TX, 77204, United States of America, xding@Central.UH.EDU
Panelists: Aleda Roth, Ruoyi Zhou, Richard Chase, Sriram Dasu, Rohit Verma

This panel will bring together academics and practitioners in the field of service innovation and service research. The panel will cover a variety of special issues about service operations in an economic downturn. Specifically, the panelists will discuss how service organization should re-examine issues such as customer experience management, service delivery, business process standardization across a variety of service sectors including hospitality, financial service, health care, etc.

■ MB49

H-Room 300, Third Floor

Work Sharing in Manufacturing, Distribution, and Services

Cluster: Workforce Engineering and Management
Invited Session

Chair: Yun Fong Lim, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, yflim@smu.edu.sg

1 - Service Quality vs. Efficiency in Tandem Systems
Eser Kirkizlar, Assistant Professor, SUNY - Binghamton, School of Management, Binghamton, NY, 13901, United States of America, eser@binghamton.edu, Hayriye Ayhan, Sigrun Andradottir

We study the dynamic assignment of servers to tasks in tandem systems with the objective of maximizing the long-run average profit. We assume that a revenue is earned each time a job is completed and that the quality of service is inversely proportional to the time a job spends in the system (we capture this deterioration in quality with a positive holding cost). We determine the optimal server assignment policy and study how this policy depends on the revenue and the holding cost.

2 - Polling Models for Real-time Picking and Sorting Systems in E-commence Distribution Centers
Yeming Gong, EM LYON Business School, 23 Avenue Guy de Collongue, Ecully, 69134, France, YGong@rsm.nl

E-commence distribution centers must rapidly organize the picking and sorting processes during and after the transaction has taken place, with the ongoing need to create greater responsiveness to customers. Sorting brings a large setup time, which cannot be admitted by existing polling models. We build a new stochastic polling model to describe and analyze such systems, and show how our analysis method can be applied to minimize warehouse cost or to improve service.

3 - Dynamics of Bucket Brigades in Systems with Fixed Stations
Esma Gel, Arizona State University, Dept of Industrial Engineering, P.O. Box 875906, Tempe, AZ, 85287, United States of America, Esma.Gel@asu.edu, Dieter Armbruster, Erika Murguia

We study the dynamics and throughput of a bucket brigade when work has to be conducted in stations that can only be occupied by a single worker. In particular, we define and consider different line reset rules, and provide insights on their performance with respect to line throughput and informational requirements.

4 - Order-Picking by Cellular Bucket Brigades
Yun Fong LIM, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, yflim@smu.edu.sg

We introduce a new design of bucket brigade order-picking. Under this new design, workers perform less unproductive travel compared with the traditional bucket brigades. We propose simple rules for workers to share work under the new design and find a sufficient condition for the system to self-balance. Numerical examples suggest that a higher throughput can be attained under the new design even with fewer and slower workers.

■ MB50

H-Room 302, Third Floor

Hole in One: Using Operations Research to Analyze Golf I

Sponsor: SpORts
Sponsored Session

Chair: Jason Acimovic, MIT Operations Research Center, 77 Massachusetts Avenue, E40-131, Cambridge, MA, 02139, United States of America, acimovic@mit.edu

1 - Statistics and Data Collection on the PGA TOUR
Michael Vitti, Director, Research and Development, PGA TOUR, 100 PGA TOUR Blvd, Ponte Vedra Beach, FL, 32082, United States of America, MikeVitti@pgatourhq.com

A presentation on the evolution of data collection and statistics on the PGA TOUR. The presentation will focus on the current data collection methods and competition statistics, as well as potential uses and availability of the data for academic research.

2 - Quitters Never Win: The (Adverse) Incentive Effects of Competing with Superstars
Jen Brown, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Chicago, IL, 60660, United States of America, jen-brown@kellogg.northwestern.edu

Theory suggests that the benefits of tournament competition depend critically on workers' relative abilities. Using panel data from pro golf, I find that a superstar's presence in a tournament is associated with lower competitor performance. High-skill PGA golfers' 1st-round scores are 0.2 strokes higher when Woods participates, relative to when he is absent. The overall tournament effect is 0.8 strokes. This effect increases when Woods plays well and disappears during his weaker periods.

3 - How to Catch a Tiger: Understanding Golfer Putting Performance on the PGA Tour

Jason Acimovic, MIT Operations Research Center, 77 Massachusetts Avenue, E40-131, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Douglas Fearing, Stephen Graves

Our goal is to evaluate golfers in a way that eliminates biases that current PGA Tour metrics contain, and to better understand where the best golfers pick up strokes. Using The PGA Tour's ShotLink data, we develop a model for predicting putts-to-go that has the capability to valuate putts that hole out as well as those that miss. Lastly, we use this putting metric to rank all players' putting performances and compare with rankings based on existing metrics.

4 - A Simulation Model to Analyze the Impact of Golfer Skill on Score

Mark Broadie, Professor, Columbia University, 415 Uris Hall, 3022 Broadway, New York, NY, 10027, United States of America, mnb2@columbia.edu, Soonmin Ko

We develop a simulation model of the play of golfers on a golf course. The model is calibrated to professional and amateur golfer data. Using the simulation model we answer questions about the impact of changes in golfer skill on average score. For example, we quantify the value of twenty additional yards in tee shot distance and the value of increased tee shot accuracy. We also assess the relative importance of long game and short game skills on average scores.

■ MB51

H-Room 303, Third Floor

Building a Solver for Integer Bilevel Programs: Theory, Algorithms, and Software

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster Computing)
Sponsored Session

Chair: Scott DeNegre, Lehigh University, Harold S. Mohler Laboratory, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, sdenegre@lehigh.edu

1 - On the Value Function of a Mixed Integer Linear Program

Menal Guzelsoy, Lehigh University, Harold S. Mohler Laboratory, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, megb@lehigh.edu, Ted Ralphs

The value function of a mixed integer linear program (MILP) is a function that returns the optimal solution value as a function of the right-hand side. In this talk, we discuss the structure of the value function of a general MILP, first focusing on the structure in the special case of a MILP with a single constraint before showing how to extend to the general case.

2 - Branch and Cut for Mixed Integer Bilevel Linear Programs: Exploiting the Lower-level Value Function

Scott DeNegre, Lehigh University, Harold S. Mohler Laboratory, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, sdenegre@lehigh.edu

We consider novel solution approaches for mixed integer bilevel programs (MIBLPs). Extensions to polyhedral techniques developed for MIPs and new valide inequalities are derived. Disjunctive cuts are from the lower-level value function. An LP method analogous to the lift-and-project method of Balas et al. is given. Generalizations of MIP heuristic and preprocessing methods are described. The Mixed Integer Bilevel Solver (MibS), a solver for MIBLP that utilizes CHiPPs, will be described.

3 - Developing Applications in CHiPPS

Ted Ralphs, Lehigh University, ISE, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Yan Xu, Scott DeNegre

In this talk, we discuss how the flexibility of the CHiPPS framework and other software modules available in COIN-OR can be leveraged to quickly develop solvers for specific problem classes. We will focus specifically on the case of our recently implemented solver for bilevel programming, which utilizes a wide range of the tools available in COIN and illustrates well the ease with which these tools can be brought together.

■ MB52

H-Room 304, Third Floor

Marketing and Operations Strategies for Perishable Products or New Products

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Dimitrios A. Andritsos, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, dimitrios.andritsos.2011@anderson.ucla.edu

1 - Revenue and Inventory Management for Perishable Products

Arvind Sainathan, University of Rochester, Simon School of Business, sainathana2@simon.rochester.edu

We consider pricing and ordering decisions faced by a retailer selling a perishable product whose shelf life is 2 periods. At the start of the first period it is new, at the start of the second period it becomes old. So every period the retailer decides the prices of new and old products, and the quantity of new product. Based on these prices and availability, customers decide what to buy with possible dynamic substitution. We consider and compare different control policies for the retailer.

2 - Maximizing Revenue of Perishable Goods through Shelf Space Allocation

Neil Geismar, Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, NGeismar@mays.tamu.edu, Milind Dawande, Chelliah Sriskandarajah

We consider the DVD rental industry, in which each newly-released title has its own revenue potential based on its box-office sales. Each display location within a store has its own effectiveness, based on visibility, so placing a DVD in a particular location generates an expected revenue. Maximizing the total expected revenue is especially important because each title's potential decays rapidly, so the display changes weekly. Display and variety constraints further complicate this problem.

3 - Optimal Pre-order Discount and Information Release

Hao Zhang, University of Southern California Marshall School of Business, zhanghao@marshall.usc.edu, Leon Yang Chu

With the proliferation of Internet retailing, selling products in advance of their actual release has gain increasing popularity. This option enables a seller to deal with consumers at an early stage when their valuations of a product are less diversified. Through an analytical model, we investigate the seller's optimal pricing strategy with the pre-order option as well as the right amount of information to release at the pre-order stage.

4 - Launching New Products through Exclusive Sales Channels

Dimitrios A. Andritsos, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, dimitrios.andritsos.2011@anderson.ucla.edu, Christopher S. Tang

A manufacturer typically introduces a new product non-exclusively through competing retailers. However, new products are increasingly launched through single sales channels via exclusive arrangements. We present two Stackelberg games to examine such arrangements. We investigate the conditions under which the manufacturer should launch the new product exclusively and examine the impact of postponing the wholesale price decision and of demand uncertainty on the manufacturer's optimal profits.

■ MB53

H-Room 305, Third Floor

Advances in Mixed Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, Department of Industrial and Systems Engineering of University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, richard@ise.ufl.edu

1 - Degree-Based Relaxations of Cliques and Stable Sets

Illya Hicks, Associate Professor, Rice University, 6100 Main St. - MS 134, Houston, TX, 77005-1892, United States of America, ivhicks@rice.edu, Benjamin McClosky

This talk will discuss algorithms for the maximum k-plex problem and the related co-k-plex coloring problem. We will present results from computational experiments and introduce a new class of facets for the k-plex polytope.

2 - Generating Cutting Planes via Dynamic Lagrangian Dual and Reduced RLT Constructs

Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com, Hanif D. Sherali

We enhance the strength of Lagrangian relaxations for solving mixed-integer programs by dynamically augmenting the Lagrangian dual with cuts induced from a disjunction implied by partial branch-and-bound enumeration. These cuts are also obtainable via an appropriate Reformulation-Linearization Technique (RLT) representation. We exploit the strength inherent in such higher-dimensional RLT reformulations, and thus also limit the number of variables controlled by subgradient optimization.

3 - A New Algorithm for Solving Relaxations of Precedence Constrained Production Scheduling Problems

Daniel Bienstock, Columbia University, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu, Mark Zuckerberg

Given a directed acyclic graph, we want to choose a closure (a set of vertices with no incoming arc) subject to side constraints of several types. In addition, we are interested in the multiperiod version of this model. Real-world problem instances have tens of millions (or more) variables and constraints. We present results with an extremely effective algorithm for optimally solving the LP relaxation of this problem.

■ MB54

H-Room 306A, Third Floor

Optimization for Online Advertisement II

Sponsor: Optimization/Networks

Sponsored Session

Chair: Aranyak Mehta, Google Research, Mountain View, United States of America, aranyak.mehta@gmail.com

1 - Algorithms for Budgeted Allocations

Gagan Goel, Graduate Student, Georgia Institute of Technology, Georgia Tech, Atlanta, GA, 30332, United States of America, gagang@cc.gatech.edu

Use of the budgeted auction model to sell advertisement space have raised several interesting algorithmic challenges. In this talk, I will present some results on the following optimization aspect of it: Given n (distinct) items and m bidders who are bidding on the items. Bidders also specify individual budget constraint. The algorithmic question is to find an allocation so that the total money obtained from this allocation is maximized.

2 - On Revenue Maximization in Second-Price Ad Auctions

Benjamin Birnbaum, University of Washington, Box 352350, Seattle, WA, 98195, United States of America, birnbaum@cs.washington.edu, Yossi Azar, Anna Karlin, C. Thach Nguyen

Most recent papers addressing the problem of allocating advertisement space for keywords in sponsored search auctions assume that pricing is done via a Ô¨Ärst-price auction, which does not realistically model the Generalized Second Price auction used in practice. In this talk, we introduce the Second-Price Ad Auctions problem, which more closely models the GSP auction. We show that the approximation complexity of this problem is quite different from that of the more-studied first-price variant.

3 - Optimizing Query Rewrites for Keyword-Based Advertising

Azarakhsh Malekian, Student, University of Maryland, College Park, AV Williams Bldg, UMD-CP, College Park, MD, 20742, United States of America, malekian@cs.umd.edu

We consider the problem of query rewrites in the context of keyword advertisement. Given a three-layer graph consisting of queries, query rewrites, and the corresponding ads that can be served for the rewrites, we formulate a family of graph covering problems whose goals are to suggest a subset of ads with the maximum benefit by suggesting rewrites instead. We obtain constant-factor approximation algorithms for these, under two versions of constraints and a realistic notion of ad benefit.

4 - Sort-Cut: A Mechanism for Multi-Unit Auctions with Budget-Constrained Bidders

Amin Sayedi, Carnegie Mellon University, 4041 Bigelow Blvd, Apt 105, Pittsburgh, PA, 15213, United States of America, amin23@gmail.com, Isa Hafalir, R Ravi

We study multi-unit auctions of a single item. A recent impossibility result [Dobzinski et al., FOCS'08] precludes the existence of a truthful mechanism with Pareto-optimal allocations in this important setting. We propose Sort-Cut, a mechanism which does the next best thing from the auctioneer's point of view, that we term semi-truthful. In our mechanism, it is a weakly dominant strategy for all agents to state their true budgets and to not understate their values.

■ MB55

H-Room 306B, Third Floor

Empirical Results on Finance-operations Interface

Sponsor: MSOM/ IFORM

Sponsored Session

Chair: John BirgeProfessor, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, john.birge@chicagogsb.edu

1 - An Empirical Study of Supply Chain Management with Trade Credit

Song (Alex) Yang, The University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, 60637, United States of America, syang1@chicagobooth.edu, John Birge

In this talk, we will present empirical results on how companies in a supply chain use trade credit.

2 - Stocking Decisions for a Public Newsvendor

Richard Lai, Assistant Professor, The Wharton School, University of Pennsylvania, Huntsman Hall, Philadelphia, PA, United States of America, lairk@wharton.upenn.edu, Vishal Gaur, Ananth Raman

We model the stocking decision of a public newsvendor, i.e., a newsvendor whose shares are listed on the stock market. Consistent with practice and literature in corporate finance, we assume some information asymmetry between the newsvendor and the market, and also assume that the newsvendor maximizes a weighted combination of its expected profit and its short-term market valuation. We study the newsvendor's operating choices and the market's valuation of the firm, with broader implications.

3 - The Effect of Product Development Restructuring on Shareholder Value

Vinod Singhal, Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St NW, Atlanta, GA, 30308, United States of America, vinod.singhal@mgt.gatech.edu, Brian Jacobs

This paper analyzes the shareholder value effects of product development restructuring (PDR) by measuring the stock market reaction associated with announcements of PDR. On average, we find a significant 0.87% increase in stock value. We also segregate our sample to determine the effects of the announcing firm's prior financial performance, intent behind the restructuring, R&D intensity, and size on the abnormal returns associated with PDR.

4 - Technological Risk, Market Value and Financial Risk of Firms in the Medical Device Industry

Kingshuk Sinha, University of Minnesota, Carlson School of Management, 321-19th Avenue S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, ksinha@umn.edu, Sriram Thirumalai

Product recalls resulting from failures of high tech products in the market place exemplify technological risks for high tech firms. In this study, we investigate how the market value and financial risk profile of firms are impacted by the announcement of a product recall. The medical device industry will serve as the empirical context of the study.

■ MB56

H-Room 307, Third Floor

Global Optimization of MPECs and Bilevel Programs

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

1 - Global Solution of Bilevel Mixed-Integer Nonlinear Programs

Alexander Mitsos, Assistant Professor, Massachusetts Institute of Technology, Department of Mechanical Engineering, 77 Massachusetts Avenue, MIT 3-158, Cambridge, MA, 02139, United States of America, mitsos@MIT.EDU

A deterministic algorithm for the global solution of bilevel mixed-integer nonlinear programs is presented. It is the first algorithm to guarantee finite termination with a global solution for programs with nonconvex functions. It is based on a recent proposal for continuous bilevel programs [Mitsos et al. JOGO 2008] and relies on a convergent lower bound and an optional upper bound. Convergence is achieved by adding upper bounds to the parametric objective value of the lower-level program.

2 - A Benders Decomposition Method for Discretely-constrained MPECs

Yohan Shim, University of Maryland, College Park, 1914 Sterling Green Dr., Morrisville, NC, 27560, United States of America, yshim@umd.edu, Steven Gabriel

We present a new variant of Benders method combined with a domain decomposition method to solve discretely-constrained mathematical programs with equilibrium constraints (DC-MPECs).

3 - Inequalities for Covering Sets via Lifting and Orthogonal Disjunctions

Kwanghun Chung, PhD Candidate, Department of Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesvile, FL, 32611, United States of America, khchung@ufl.edu, Jean-Philippe Richard, Mohit Tawarmalani

We discuss our recent results on valid inequalities for nonlinear covering sets. These results highlight the importance of orthogonal disjunctions in the derivation of valid inequalities and emphasize the potential of lifting for mixed integer sets. In particular, we provide convex hull descriptions of continuous polynomial covering sets and facet-defining inequalities for their 0-1 mixed integer counterparts.

4 - On the Application of Partial B-regularity to a Class of Repeated Game Models Formulated as MPECs

Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

We present an optimization model that describes a collusive game among non-cooperative players. The problem contains an implicit optimal value function and is reformulated to a mathematical program with equilibrium constraints (MPECs). It is shown that the (convexified) MPECs satisfy the so-called partial B-regularity, and hence, any B-stationary point of such an MPEC is a globally optimal solution.

■ MB57

H-Room 308, Third Floor

Healthcare Potpourri

Sponsor: Health Applications
Sponsored Session

Chair: Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu

1 - Design and Analysis of Ambulance Diversion Policies

Adrian Ramirez Nafarrate, Arizona State University, 607 W. 19th Street A13, Tempe, AZ, 85281, United States of America, adrian.ramirez@asu.edu, Teresa Wu, John Fowler, Esma Gel

The overcrowding situation in Emergency Departments (ED) of hospitals causes multiple problems affecting the patients, such as long waiting times, patients leaving without treatment, boarding and ambulance diversion.Even though EDs have been studied recently, analytical tools have not been applied extensively on the design and analysis of diversion policies.This research uses Simulation and Markovian models to study the trade-offs of diversion policies and the impact on the performance of the ED

2 - Staffing for Disease Management: The Third Party Payer Perspective

Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu, Amy R. Wilson, Scott Sandok

Saddled with increasing healthcare costs, health insurance organizations in the United States are looking at new ways to improve health outcomes using telephonic interventions. The uncertainty involved in these interventions leads to questions regarding 1) staffing levels and 2) measurement of the effectiveness of the interventions. We present a case study from BlueCross BlueShield of Minnesota that examines these questions.

3 - The Payer Has Problems

Amy R. Wilson, Blue Cross and Blue Shield of Minnesota, 3535 Blue Cross Road, R259, Eagan, MN, 55122, United States of America, Amy_R_Wilson@bluecrossmn.com

The responsibilities of health insurance companies, or third party payers, have evolved from paying claims to also include improving the health of their members, creating innovative benefit designs, and creating networks that provide broad access to high quality/low cost healthcare providers. Problems faced by the payer have not been widely studied. This talk will describe how they may be amenable to operations research techniques, and the challenges posed by the data available to the payer.

4 - Multi-Criteria Models for Physician Productivity Measurement

John Osborn, Operations Manager, Mayo Clinic, 200 1st St SW, Mary Brigh 2-505, Rochester, MN, 55905, United States of America, Osborn.John@mayo.edu

Efficient use of resources is a critical issue for health care providers. At an academic medical center, physicians and surgeons have obligations beyond patient care, yet typically measures of academic productivity are qualitative and subjective. This paper proposes a multi-criteria model for evaluating physician productivity at an academic medical center, with considerations for pay-for-value and pay-for-performance reimbursement schemes.

■ MB58

H-Room 309, Third Floor

Supply Chain Scheduling Cooperation, Coordination and Subcontracting

Cluster: Scheduling
Invited Session

Chair: Zhi-Long Chen, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@rhsmith.umd.edu

Co-Chair: Lei Lei, Rutgers University, Dept of SCM & Marketing Sci., Rutgers Business School, Newark & New Brunswick Campuse, NJ, United States of America, llei@andromeda.rutgers.edu

1 - Conflict Resolution in a Two Stage Production Line

Manoj Vanajakumari, Texas A&M University, Department of Engineering Technology and, United States of America, manoj@entc.tamu.edu, Chelliah Sriskandarajah, Edouard Wagneur

We study a two-stage production system connected by an intermediate buffer. The objective of the paper is to find schedules for the two stages which minimize the system cost. The problem is shown to be NP-hard. We demonstrate that the cost saving which cooperation between the stages provides is significant.

2 - Production and Logistics Coordinated Scheduling Problems in the Steel Industry

Lixin Tang, Northeastern University, The Liaoning Key Lab. of Manuf. & Logist, The Logistic Institute, Shenyang, 110004, China, lixintang@mail.neu.edu.cn

Production and logistics coordination is critical in steel industry. Effective coordinated scheduling can significantly improve WIP inventory, lower energy consumption and reduce logistics cost. We study coordinated scheduling of: 1) production and warehousing; 2) production and transportation. Computational complexity is analyzed. For NP-hard problems, heuristics with worst-case analysis or optimization algorithms are proposed. For polynomial solvable cases, effective algorithms are given.

3 - Time Sensitive Capacity Allocation Issues in Subcontracting

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu, George Vairaktarakis

We study the subcontracting strategies of a manufacturer utilizing processing capacity both in-house and at a third-party which is common to competing manufacturers. In this setting, a time-sensitive capacity allocation problem arises since every manufacturer balances the in-house production and outsourcing costs, his sensitivity to delay, and effects of competitors. We consider and evaluate the third-party's and the manufacturers' performance in both centralized and equilibrium schedules.

4 - On Multimodal-Shipping Scheduling Problem with Customer Receiving Deadlines

Lei Lei, Rutgers University, Dept of SCM & Marketing Sci., Rutgers Business School, Newark & New Brunswick Campuse, NJ, United States of America, llei@andromeda.rutgers.edu, Gang Wang

We derive the minimum-cost operation schedules for a shipping network of many suppliers, distribution centers and customers subject to the capacity and time window constraints. We show the structure properties of this problem, and present a solvable case via decomposition. An approximation algorithm for the general cases is discussed.

■ MB59

H-Room 310, Third Floor

Tutorial: OR's Next Top Model: Decision Models for Infectious Disease Control

Cluster: Tutorials
Invited Session

Chair: Elisa Long, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu

Co-Chair: Margaret Brandeau, Professor, Stanford University, 407 Terman Engineering Center, MS&E Department, Stanford, CA, 94305, United States of America, brandeau@stanford.edu

1 - OR's Next Top Model: Decision Models for Infectious Disease Control

Elisa Long, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu, Margaret Brandeau

Infectious diseases continue to threaten many populations and timely control of these epidemics is a global health priority. Mathematical models can be used to estimate the costs and benefits of disease prevention, diagnostic, and treatment interventions, and to aid policymakers with allocating limited disease-control resources. We describe several OR-based models used to analyze such problems. We illustrate each class of model with a published example applied to HIV/AIDS intervention policies.

■ MB60

H-Room 311, Third Floor

Revisiting Interior Point Methods

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Revisiting Homogeneous Self-Dual Method for Linear Programming

Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, Kuo-Ling Huang

The homogenous self-dual formulation has many advantages over the standard KKT based formulations to construction primal-dual interior point methods. Computational performace of a potential reduction based implementation of such a method is not known. We will present computational results showing that the number of iterations in this method are similar to the standard interior implementations while ensuring a worst case complexity.

2 - On the Complexity of L-p Norm Minimization for p Less than One

Yinyu Ye, Professor, Stanford University, Terman 316, Stanford University, Stanford, CA, 94305, United States of America, yyye@stanford.edu

Recently, L-p norm minimization for p less than 1 is used to compute a sparse solution for a system of linear equations. We show that the problem is NP-hard for all 0<p<1. On the positive side, we show that the interior-point potential reduction or affine scaling algorithm works well to compute a local minimizer in FPTAS time.

3 - A Row-by-row Interior-point Method for Semidefinite Programming

Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Donald Goldfarb, Shiqian Ma, Katya Scheinberg

We present an interior-point method for semidefinite programming (SDP) that iteratively updates a single row (and column) of the unknown matrix at each iteration. The method uses both the properties of the Schur complement and an augmented Lagrangian approach. Numerical results will be presented to illustrate the method's ability to solve very large SDPs in a very modest amount of time.

■ MB61

H-Room 312, Third Floor

Facility Location under Disruption Risks

Sponsor: Location Analysis
Sponsored Session

Chair: Ho-Yin Mak, The Hong Kong University of Science and Technology, Department of IELM, HKUST, Clear Water Bay, Hong Kong, Hong Kong - PRC, hymak@ust.hk

1 - Risk-Diversification and Risk-Pooling in Supply Chain Design

Ho-Yin Mak, The Hong Kong University of Science and Technology, Department of IELM, HKUST, Clear Water Bay, Hong Kong, Hong Kong - PRC, hymak@ust.hk, Max Shen

Recent research has pointed out that the optimal strategies to mitigate supply disruptions and demand uncertainty are often mirror images of each other. In particular, risk-diversification is favorable under the threat of disruptions and risk-pooling is favorable under demand uncertainty. We show that supply chain networks that allow small to moderate degrees of dynamic sourcing provides partial benefits of both strategies and can be very robust against both disruptions and demand uncertainty.

2 - Conic Program for a Capacitated Location-Inventory Model with Unreliable Supply and Transportation

Gemma Berenguer, PhD student, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, 94720-1777, United States of America, gemmabf@berkeley.edu, Alper Atamturk, Max Shen

In some supply chain settings, link disruptions are as relevant as node disruptions. We present a formulation of a capacitated location-inventory model with risk pooling that incorporates supply and transportation disruption risks. The model is a nonlinear mixed-integer problem that we solve by reformulating it as a second-order conic mixed-integer program. We show computational effects of varying DC capacities, inventory and shipping costs and we improve them by adding valid cuts.

3 - Pre-disaster Protection Planning Against Disruptions Affecting Large Geographical Areas

Federico Liberatore, PhD Student, Kent Business School, University of Kent, Canterbury, CT2 7PE, United Kingdom, fl51@kent.ac.uk, Mark Daskin, Paola Scaparra

We present a model to plan for the fortification of critical system components in the face of disastrous events that affect wide areas, such as floods, earthquakes, hurricanes, and the spreading of biological and chemical agents. Both heuristic and optimal solution approaches are shown.

■ MB62

H-Room 313, Third Floor

Behavioral Modeling and Experiments

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Diana Wu, Univerisity of Kansas, 1300 Sunnyside Ave., Lawrence, United States of America, dianawu@ku.edu

1 - Adaptive Estimation of Bounded Rationality and Risk Preferences

Tad Hogg, HP Labs, MS 1139, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, tad.hogg@hp.com, Kay-Yut Chen

We describe calibrating behavioral economic decision models with simple decision problems. To minimize the required number of decisions, we propose an adaptive procedure that dynamically constructs test decisions to measure the levels of two key behavioral effects: bounded rationality (propensity to make inconsistent choices) and risk aversion in individual decision-makers. Simulation experiments show this approach outperforms a static process where test decisions are all pre-determined.

2 - Comparison of Perceptions and Behavior in Ticket and Physical Queues

Kaan Kuzu, The Pennsylvania State University, Smeal College of Business SC&IS Dept., 471B Business Building, University Park, PA, 16802, United States of America
kzk107@psu.edu, Susan Xu, Christopher Craighead

We designed an empirical study to obtain insights into participant perceptions of and behavior within different queuing arrangements. We specifically focused on the decision making process and the patience of the participants before and during waits in ticket and physical queue arrangements. We also examined the impact of time pressure and patience on the perceptions of ticket and physical queues.

3 - Newsvendor Order Distribution under Contracts with Threshold
Diana Wu, Univerisity of Kansas, 1300 Sunnyside Ave., Lawrence, United States of America, dianawu@ku.edu, Kay-Yut Chen

We use a series of experiments to study the behavior of a newsvendor retailer under supply chain contracts that involve threshold, for example, quantity discounts and sales target rebate. All earlier newsvendor experiments focus on the analysis of the average of ordering decisions. In this study, we look at the overall order distributions under different contracts. We propose a behavioral model based on quantal response to describe the observed behavioral changes in order distributions.

■ MB63

H-Room 314, Third Floor

Drugs in Health Care

Contributed Session

Chair: David Czerwinski, Assistant Professor, San Jose State University, One Washington Square, San Jose, CA, 95192, United States of America, david.czerwinski@sjsu.edu

1 - Does Medicare Part D Influence Physicians' Prescribing Patterns?: Long-term Care Center Study
Changmi Jung, PhD Student, Carnegie Mellon University, 4800 Forbes Ave. Rm 242, Pittsburgh, PA, 15213, United States of America, changmi@cmu.edu, Rema Padman

We would like to understand if Medicare Part D influences physicians' drug prescribing patterns in long-term care centers. We believe that physicians typically prescribe generic or preferred drugs based on the insurance plan of the patients, but it does not happen in many cases because of varied information and coverage of each plan. We collect prescription order data from an online pharmacy which has 120 long-term care center clients and analyze it to answer the above question.

2 - An Improved Distribution Contract for the Pharmaceutical Industry
Kathleen Martino, PhD Candidate, Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States of America, martinok2@gmail.com, Yao Zhao

We compare the current Fee-for-Service (FFS) contract in the US pharmaceutical supply chain to a Fee for Distribution (FFD) contract for brand drugs using a model-based mathematical approach. We consider predictable demand and show that the FFD contract outperforms the current FFS contract by reducing the distributor's inventory and smoothing the manufacturer's demand.

3 - An Optimization-based Approach to Drug Safety Surveillance
David Czerwinski, Assistant Professor, San Jose State University, One Washington Square, San Jose, CA, 95192, United States of America, david.czerwinski@sjsu.edu, Dimitris Bertsimas

Ensuring the safety of the US drug supply continues to be a pressing concern, with the recall of Vioxx earlier this decade and problems with tainted supply chains more recently. Insurance claims data are a promising source for detecting unexpected adverse reactions to drugs. We will discuss the statistical challenges involved in monitoring drug safety and present an optimization-based surveillance method. Simulation results comparing our approach to existing methods will also be presented.

■ MB64

H-Room 202A, Second Floor

Communication Instruction in Engineering and Business Schools II

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Judith Norback, Dir., Workplace & Academic Comm, Stewart School of Indus & Sys Engineering, Georgia Tech, 755 Ferst Drive, Atlanta, GA, 30332, United States of America, jnorback@isye.gatech.edu

Co-Chair: Elke Leeds, Assistant Professor, Kennesaw State University, School of Accountancy Coles College of B, 1000 Chastain Road - Bldg. #4 Office - B, Kennesaw, GA, 30144, eleeds@kennesaw.edu

1 - Professional Presentation as Performance
Rick Evans, Director, Engineering Communications Program, Cornell University, College of Engineering, Rae27@cornell.edu

Performance is a 'contested concept' that emerges from a range of disciplines. It is most commonly understood as a recurring collection of actions carried out for someone else with a self conscious, reflexive awareness. Performance is a useful concept for teaching presentations because it replaces the transmission of information as the focal aim with the experience of meaning and therefore emphasizes the design of that experience. Consequently, students understand themselves in their presentations to be acting in ways to create an experience that in turn allows others to act as well.

2 - Developing the Professional Communications for Engineers Course at Texas Tech University
Dean Fontenot, Sr. Director T-STEM Center, Texas Tech University, College of Engineering, Dean.fontenot@ttu.edu

Because of the concern that students were not graduating from the College of Engineering with good communication skills, I was asked to develop and deliver a course that would not only address ABET criteria but would help engineering students to become better oral, written, and internet communicators. This presentation will discuss the development and delivery of the course, how it addresses accrediting boards' criteria, fits into the core curriculum, and how we are investigating ways to replicate the course in order to serve the large number of engineering students at Texas Tech University.

3 - Preliminary Scoring System for Engineering Student Presentations, Based on Executive Input
Judith Norback, Dir. of Workplace and Academic Communication, Georgia Tech, Stewart School of Industrial and Systems, judith.norback@isye.gatech.edu, Tristan T. Utschig

At Georgia Tech, we have created a preliminary scoring system for engineering student presentations. The scoring system is based on input from business executives during structured focus groups. We identified six categories of skills from the executives' input: 1) Customizing the presentation to the audience, 2) Interacting with the audience, 3) Delivering the presentation, 4) Telling the story, 5) Sequencing the topics, and 6) Focusing on key points. We will give examples of each of these categories and share with the audience the resulting 4-level preliminary scoring system

4 - Integrating Managerial Presentation Skills in Business School Courses on Spreadsheet Analytics & Management Science
Thomas A. Grossman, Associate Professor of Finance & Quantitative Analytics, University of San Francisco, School of Business and Management, San Francisco, CA, tagrossman@usfca.edu, Mouwafac Sidaoui

We teach MBAs to be effective business analysts by delivering the Business Analytics Lifecycle of Modeling/Formulation, Spreadsheet Engineering, Analytics, Interpretation, and Communication. We will discuss how we help students encapsulate a complex analysis in a presentation that speaks to a managerial audience. And we will describe "asynchronous PowerPoint" in business and the importance of stand-alone PowerPoint decks.

■ MB75

C-Room 32A, Upper Level

Railway Crew Scheduling

Sponsor: Railroad Applications
Sponsored Session

Chair: Kamalesh Somani, Mgr Operations Research, CSX Transportation, 500 Water Street, Jacksonville, FL, 32258, United States of America, Kamalesh_Somani@CSX.com

1 - A Decision Support System for Railroad Crew Planning
Krishna Jha, Innovative Scheduling Systems, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States of America, krishna@innovativescheduling.com, Ravindra Ahuja, Amit Agarwal

Railroads do crew planning based on crew districts and different crew districts have different configurations - one home and one away location, multiple home and/or multiple away locations, short-long pools, triangular pools, etc. We have developed a decision support system for crew planning that can handle various types of crew districts in an integrated manner. We will describe the features of this system and give its demonstration.

2 - A Simulation-based Crew Planning Model to Improve Crew Utilization and Train Performance
Yudi Pranoto, Operations Research Specialist, Norfolk Southern, 1200 Peachtree St. NE, Atlanta, GA, 30309, United States of America, yudi.pranoto@nscorp.com, Clark Cheng

Norfolk Southern developed a simulation-based crew planning model to evaluate the impact of changes in government regulation, union agreement and train schedule on crew utilization and train service. We will present the motivation behind the development of this model and its usage. We will describe in detail key modules of this system such as crew deadheading and detention, relieve crew, and animation.

3 - Strategic and Real-time Crew Scheduling Models at CSX Transportation

Kamalesh Somani, Mgr Operations Research, CSX Transportation, 500 Water Street, Jacksonville, FL, 32258, United States of America, Kamalesh_Somani@CSX.com, Jagadish Jampani

Railway crew scheduling problems are complex in nature. Currently, it is mostly a manual process resulting in avoidable expenses and planning time. Crew scheduling is dependent on configurations like single/doubly-ended, split, triangle, short/long pools. In the past, CSX implemented a strategic crew planning system for single/doubly-ended configurations. Recently, we added an array of network flow models to address more complex configurations from both strategic and real-time perspectives.

■ Interactive Session

Monday, 12:30pm - 1:30pm

Exhibit Hall

1 - ORA Network Analysis Software

Terrill Frantz, Carnegie Mellon University, ISR/SCS 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, terrill@org-sim.com

Used to locate individuals and groups that are risks given social, knowledge and task network information. Using the visualization and computational features the health of an organization can be assessed; key actors who by virtue of who they know, what they know, and what they are doing can be identified.

2 - Data Mining Application for Personnel Selection and Performance Evaluation in Banking Sector

Ertan Guner, Professor/ Doctor, Gazi University, Celal Bayar Boul. 06570, Maltepe, Ankara, Turkey, erguner@gazi.edu.tr, Hamdi Bilen, Kemal Alaykiran

As the communication technologies have been progressing, it has been easier to reach current information and knowledge discovery concept has increasingly become important. The necessity of turning huge amounts of data into useful information indicates the importance of data mining. Personnel quality is an important point for companies in order to maintain competitive advantages. In this study, an effective personnel selection mechanism is improved by classification and clustering methods.

3 - Efficient Frontier in Consumer Loan Decision when Considering Profit, Volume and Variance on Profit

Kanshukan Rajaratnam, Student, University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States of America, kanshu@virginia.edu

Literature describes choosing between consumer credit scorecards in a manner that is efficient with respect to a set of conflicting business objectives, such as profit, market share, and losses. We extend the above to include variance in profit as a constraint. We construct the efficient frontier where the portfolio manager is faced with the decision to choose a scorecard when creating a portfolio that is efficient with respect to profit and volume while within the variance on profit constraint.

4 - Ranking College Football Teams with AHP Concepts

Yepeng Sun, PhD Student, University of Louisville, 789 Eastern Pkwy, Apt 4, Louisville, United States of America, y0sun010@louisville.edu, Gerald Evans

Analytical Hierarchy Process(AHP) has proved to be an appropriate approach to deal with inconsistent problems. This presentation will introduce a new approach to rank football teams with a method evolved from AHP concepts.

5 - Sourcing Strategies for Relief Agencies Given In-kind Donations Availability

Luther Brock, Doctoral Student, North Carolina A&T State University, 404 McNair Hall, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, lbrock@ncat.edu, Lauren Davis

This research studies the challenges faced by relief agencies when providing prolonged assistance during disaster relief. A mathematical model identifies sourcing decisions over a finite time horizon by balancing capital investments from transshipments and local market purchases with the consequences of processing capacity degradation resulting from handling undesired items comingled with donations received.

6 - Design Insights for Warehousing Systems Using Autonomous Vehicles Technology

Debjit Roy, Research Assistant, University of Wisconsin-Madison, Dept of ISyE, 1513 University Avenue, Madison, WI, 53706, United States of America, droy@wisc.edu, Ananth Krishnamurthy

Autonomous vehicle storage and retrieval systems (AVS/RS) represent a relatively new and flexible technology that is used as an alternative to crane-based AS/RS. In AVS/RS, autonomous vehicles provide horizontal movement within a tier whereas lifts provide vertical movement between tiers. In this research, a detailed simulation model is used to understand the effect of design parameters such as vehicle assignment rule, number of zones and location of the cross-aisle on system performance.

7 - Pattern Recognition and Sequence Analysis in Communications

Selcen Phelps, Westminster College, 501 Westminster Ave, Fulton, MO 65251, United States of America, selcen.phelps@westminster-mo.edu, William Guinee

In an extension of pattern recognition methodology to the social sciences, we use encoding, counting algorithms, and statistical methods (such as the Binomial Test), to test hypotheses regarding patterns in communications. An anthropology application analyzes Alcoholics Anonymous narratives to discover significant themes and sequences. Other applications are being proposed for the analysis of human decisions and dialogue, most notably in the framework of social media.

8 - The Development of a Multi-modal Trip Planner

Jing-Quan Li, Assistant Research Engineer, Calfornia PATH, UC Berkeley, Richmond, CA, 94804, United States of America, jingquan.li@gmail.com

We will discuss the development of a multi-modal trip planner for metropolitan areas. The planner will provide different transportation modes, including driving, transit and park-and-ride. The real-time traffic and transit information is incorporated.

9 - Intellectual Property Management in Japanese Companies

Koichiro Kato, Professor, Kanazawa Institute of Technology, 1-3-4-12F, Atago, Minato-ku, Tokyo, 105-0002, Japan, kkato@neptune.kanazawa-it.ac.jp, Kazunari Sugimitsu

Intellectual property management is important in technology management. Intellectual property department is in charge of strategic intellectual property management. But the relations between the department and intellectual property management are not clear. We investigated about the relations in Japanese companies by questionnaires to clear the points and analyzed statistically.

10 - Reverse Logistics Network Design and a Mixed Integer Programming Model for Accumulator Recycling System

Bahar Ozyörük, Assistant Professor, Gazi University, Gazi University Faculty of Achitecture, and Engineering Industrial Eng. Dept., Ankara, 06520, Turkey, bahar@gazi.du.tr

The paper deals with the recycling network design which is a reverse logistics activity. A mixed integer programming model with multi-product aiming at minimazing the cost for accumulator recycling system is developed and the real system tried to modelling.

11 - Tactical Production Planning with Deterioration and Perishability

Julia Pahl, Research and Teaching Assistant, Universitat Hamburg, Von-Melle-Park 5, Hamburg, Germany, pahl@econ.uni-hamburg.de, Stefan Voss, David Woodruff

As organizations move from creating plans for individual production lines to entire supply chains it is important to recognize that planning decisions impact the quality-state of products. Products passing their useful lifetime impose high costs due to inventory loss or the need to rework them. We provide some interesting insights.

12 - Solving Order Acceptance and Capacity Planning in Make-to-Order Operations with Branch and Price

Siddharth Mestry, Research Assistant, Florida International University, 10555 W Flagler St., EC 3120, Miami, FL, 33174, United States of America, smest001@fiu.edu, Purushothaman Damodaran, Chin-Sheng Chen

Make-to-Order firms can make sustainable profits by selectively accepting customer orders and simultaneously planning for their capacity. To solve this integrated problem, we propose a Mixed-Integer Linear Program. We decompose this MILP into a master problem and one or more sub-problems and solve it using an exact Branch and Price algorithm. We also propose an approximate branch and price scheme, lagrangean bounds and approximation algorithms to solve the problem efficiently.

13 - Estimating the Term Structure of Credit Spreads in Illiquid Markets

Gonzalo Cortazar, Professor, P. Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago, Chile, gcortaza@ing.puc.cl, Claudio Tapia

This paper presents a methodology for estimating a family of credit spread term structures in a market with few transactions. We propose partitioning the market into risk classes, such as credit ratings, and modeling credit spread term structures for each risk class using a multifactor Vasicek model with some common and some risk-class-specific factors. The model is jointly estimated using an Extended Kalman Filter. An application using Chilean corporate bonds is presented.

14 - An Analysis of Knowledge Affected by Differences of Work Experience in Intellectual Property Field

Masako Wakabayashi, Association of Intellectual Property Education, 3-13-7-3F, Nishishinbashi, Minato-ku, Tokyo, 105-0003, Japan, wakabayashi@ip-edu.org, Atsushi Inuzuka, Toshiya Watanabe, Nozomi Ashida, Koichiro Kato, Kazunari Sugimitsu

It is important for human resources in intellectual property field to acquire knowledge closely relevant to business practice. Therefore, we analyze the examinee data of "The Examination of Proficiency in Intellectual Property" as proxy variable, with the intention of making clear what kind of knowledge is affected by work experience.

15 - Redundancy and Projection Operation in Lift-and-project Procedures for the Max-cut Problem

Jiwoong Choi, Korea University, 1, 5Ka, Anamdong, Seongbookku, Seoul, Korea, Republic of, miracleno7@korea.ac.kr, In-Chan Choi

We address implementation issues in lift-and-project procedures for the max-cut problem. A redundancy checking scheme is considered to deal with exponential growth in constraints. Also, projection operators are examined for efficient projection of lifted polyhedrons onto original space. Preliminary computational results based on three lift-and-project methods are presented.

16 - Operations Research for Early Diagnosis of Breast Cancer

Turgay Ayer, University of Wisconsin, 1513 University Ave., Madison, WI, 53708, United States of America, tayer@wisc.edu, Oguzhan Alagoz, Natasha Stout, Elizabeth Burnside

Breast cancer is the most common cancer and second leading cause of death among US women. When detected early through screening, the disease is effectively curable. Although mammography is the most common screening modality, its false negative and false positive rates are high. We build an artificial neural network (ANN) to improve the accuracy of risk prediction in mammography reading and a partially observable Markov decision process (POMDP) model to optimize mammography decisions.

17 - A Quantitative Approach Towards Sustainable Organizations

Fikret Turan, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, fkt1@pitt.edu

A new, comprehensive management tool for organizational sustainability using stakeholder theory, analytic network process and stochastic programming has been developed and tested to create an optimal investment portfolio. The portfolio balances economic, social and environmental aspects (i.e., the triple bottom line) with internal rate of return.

18 - Evaluating Emergency Medical Service Dispatching Policies

Rebecca Dreiding, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave, Richmond, VA, 23284, United States of America, dreidingra@vcu.edu, Laura McLay, James Denison

How to locate and dispatch ambulances responding to 911 calls is a major responsibility of emergency medical service systems. This research provides a model for optimizing dispatching protocols, which potentially has a large effect on patient outcomes. Our model sheds light on when to dispatch the closest medical unit to a call and when to dispatch a farther medical unit to a call.

19 - Revenue Management and Capacity Allocation with Limited Information in Global Air Cargo Operations

Ravi Kumar, Distinguished Professor and Dean, KAIST Busness School, Seoul, 130702, Korea, Republic of, Rkumar@marshall.usc.edu, Seungbeom Kim

With limited information on demand, several models to improve the revenues of an air cargo company are developed, with focus on capacity allocation to their global regional sales offices. The results show that their revenue increases significantly even when we use the simplest developed models compared to their current methods.

20 - A Heuristic Based Scheduling System for Diffusion Processing in Semiconductor Manufacturing

Tanju Yurtsever, Freescale Semiconductor, Inc., 6501 William Cannon Drive West, Austin, TX, 78735, Tanju.Yurtsever@freescale.com, Erhan Kutanoglu, Jennifer Johns

This talk addresses the scheduling of lots in a specific wafer fabrication area, called diffusion, where scheduling of lots interact with batching, equipment dedication, and queue time constraints. Realizing the difficulty of solving the underlying mathematical program optimally, we develop a heuristic to regularly schedule the lots available in the area in real time. The talk explains the user interface and implementation issues as well as the details of the heuristic logic. The results obtained from production in a wafer fabrication facility to date show high user compliance, improved predictability and visibility of the overall schedule, and improved operational performance including reduced cycle times and queue time violations.

21 - Optimal Design of Business Processes

Ronald Giachetti, Associate Professor, FIU, 10555 W. Flagler Street, Miami, FL, 33174, United States of America, giachetr@fiu.edu

This paper develops a queueing network model that incorporates the division of labor and coordination between activities. An optimization model to minimize the cycle time subject to a maximum number of servers is presented. We derive an upper bound on the number of subtasks and present an algorithm to optimally solve the problem. The model, analytical, and numerical results provide a means to determine the optimal number of subtasks for a process that was until now missing from the literature.

22 - A Linear Model for an Integrated Location-inventory Problem with Time-based Service Level Constraints

Eissa Nematollahi, York University, 4700 Keele Street, Toronto ON, N2L 3G1, Canada, eissa@yorku.ca, Abdullah Dasci, Fatma Gzara

We present an integrated network design and inventory problem in service-parts logistics systems design. The existing models are usually very difficult to solve due to demand uncertainty and highly nonlinear service-level constraints. Exploiting unique properties of the nonlinear constraints, we provide an equivalent linear formulation, which can be solved quickly and efficiently.

23 - How to Protect Intellectual Property under R&D Outsourcing

Rajorshi Sen Gupta, Research Fellow, Texas A&M University, College Station, College Station, TX, 77840, United States of America, rajorshi@tamu.edu, H Alan Love

R&D outsourcing has become a strategic tool for companies to abate production costs/develop new products. While sharing of intellectual property by clients can facilitate vendor learning, it can also lead to eventual misappropriation . We design an incentive compatible mechanism that can help companies protect their IP while outsourcing R&D.

24 - Multi-objective Healthcare Decision Support: Case Studies in UK and China

Dylan Jones, Principal Lecturer, University of Portsmouth, Department of Mathematics, Lion Terrace, Portsmouth, PO1 3HF, United Kingdom, dylan.jones@port.ac.uk, Mehrdad Tamiz, Patrick Beullens

Two case studies relating to multi-objective decision support are presented. The first pertains to the planning of a medical assessment unit in an acute care hospital in Portsmouth, UK. A combination of goal programming and simulationis used to provide information on resource levels and answer what/if questions. The second relates to a general hospital in Zichaun, China. A combination of goal programming and queuing theory is used to allocate beds amongst departments.

25 - Gemcutting Strategies for Fast Simplex Variants and Combinatorial Proofs on Polytopes

Anand Kulkarni, University of California, Berkeley, 4141 Etcheverry Hall, Berkeley, CA, United States of America, anandk@berkeley.edu

We present a new technique for determining how the edge-vertex graph of a polytope and paths between vertices are modified by constraint perturbations and cutting planes. This method has direct applications in determining faster Simplex-like algorithms for linear programming, and has yielded new results in outstanding problems in the theory of polytopes, including the Hirsch conjecture and questions about random walks on polytopal graphs.

26 - Product Pricing and Company Wealth: An Example From Airline Industry

Min Shi, Assistant Professor, California State University Los Angeles, 5151 State University Drive, Los Angeles, CA, 90032, United States of America, mshi2@calstatela.edu

The current literature extensively documents the relationship between price strategy and stockholder wealth, but there is limited evidence on its impact on bondholders. This paper is to fill this gap by investigating the influences of the price strategy on the bond values in the airline industry during the period from 1984 to 1998. This paper also examines the wealth transfer effect between stockholders and bondholders caused by price changes.

27 - Bound on Expected Objective Value of a Linear Programming with Uncertainty

Phantipa Thipwiwatpotjana, University of Colorado at Denver, Campus Box 170 Campus Box, P.O. Box 173364, Denver, CO, 80217, United States of America, phantipa.thip@ucdenver.edu, Weldon Lodwick

There are three types of uncertainty: probabilistic, possibilistic and interval. We use random set to be a unify approach and generate the corresponding density functions that will be used in the deterministic equivalent stochastic recourse models of a given linear programming model with uncertainty.

28 - A Fuzzy Combinatorial Optimization Model
Elizabeth Untiedt, Graduate Student, University of Colorado Denver, Campus Box 170, P.O. Box 173364, Denver, CO, 80217, United States of America, euntiedt@yahoo.com

Mathematical models of the inherently fuzzy systems in social sciences are well-suited for fuzzy optimization. The present work is a dynamic model for the propagation of West Nile Virus, where the relationships between disease vectors (crows) are fuzzy. The result is a fuzzy combinatorial optimization problem, which, given the source node, predicts the spread of the disease.

29 - Optimal Security Response to Attacks on Open Science Grids
Zhen Xie, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, zhenxie@mcs.anl.gov, Mine Altunay, Sven Leyffer

Cybersecurity is a growing concern, especially in open grids, where attack propagation is easy because of prevalent collaborations among thousands of users and hundreds of institutions. A common concern is that the increased openness may allow malicious attackers to spread more readily around the grid. We present new grid models on how to optimally respond to attacks in open grid environments.

30 - Metamodeling-based Optimization Studies: Simulations and Experiments
Mauricio Cabrera-Rìos, Assistant Professor, University of Puerto Rico at Mayagüez, PO Box 1717, Boqueron, PR, 00622, Puerto Rìco, mauricio.cabrera1@upr.edu, Marìa Villarreal, Yareni Lara, Esmeralda Niño-Pérez, Shirley Rojas

Two studies involving the use of a proposed iterative metamodeling-based optimization method are here presented. The first case approaches an injection molding simulation optimization project and is aimed to contrast the use of the iterative method against the use of a single metamodel. The second case uses the method in a small scale experimental optimization task to demnostrate wider applicability. Encouraging results on convergence and quality of solutions are found and discussed.

31 - Introducing Statistic Analysis in Materials Science Projects at Different Points in Time
Mauricio Cabrera, Assistant Professor, University of Puerto Rico at Mayagüez, 250 North Post Road, Mayaguez, PR, 00681, Puerto Rico, applied.optimization@gmail.com, Oscar Chacon, Marcelo Suàrez, Oscar Perales, Yarilìn Cedeño-Mattei, Matilde Sànchez-Peña, Yareni Lara

Four cases in materials science where the use of statistics is introduced at different points in time are presented. The nature and structure of the data, as well as data availability play an important role on determining how to use statistics to achieve results as close as possible to the initial goals of the studies. A taxonomy of situations for materials science laboratories is seeked in this work.

32 - Effects of Donations on Humanitarian Relief Performance: A Simulation Study
Lauren Davis, Assistant Professor, North Carolina A&T State University, 404 McNair Hall, 1601 East Market Street, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu, Daniel Mota

Humanitarian organizations often rely on the contributions of donors to assist in their relief efforts. However, unsolicited donations have the potential to cause bottlenecks in the relief supply chain as resources are diverted to transport and sort through the supplies. We develop a discrete-event simulation model to study the impact of donations on relief performance. We evaluate three coordination strategies and measure the benefit in terms of demand fulfillment and resource utilization.

33 - A New Holistic Method for Complex Network Reliability Approximation & Critical Components Detection
Chi Zhang, Stevens Institute Of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, chi_zhang@live.com, Jose Ramirez-Marquez

Reliability of complex networks is too complex to be analyzed via traditional techniques. A new algorithm (R-Dijkstra) was first proposed to compute the lower bound of two-terminal binary complex network reliability. The problem to detect the critical components of complex networks was then modeled as a multi-objective DNIP and solved by combining R-Dijkstra with MO-PSDA. This new holistic method makes it possible to estimate the reliability of a complex network and find its critical components.

34 - Finite Buffer Fluid Models with Overflow Protection: Applications in Queueing Models
Liqiang Liu, EURANDOM, Eindhoven University of Technology, Netherlands, liu@eurandom.tue.nl

Queueing models with workload-dependent balking has been arising from wide applications such as inventory and service systems (blood bank, call centers, health care etc.) In a queue with workload-dependent balking, an arriving customer joins the queue and stays until served if and only if the system workload is no more than a fixed level at the time of his arrival. The present paper is an extension of our previous work to a more general setting. We begin by considering a fluid model where the buffer content changes at a rate determined by an external stochastic process with finite state space. We derive systems of first-order linear different equations for the mean and LST (Laplace-Stieltjes Transform) of the busy period in this model and solve them explicitly. We obtain the mean and LST of the busy period in the corresponding queueing model as a special limiting case of this fluid model. We demonstrate several applications of our method. We illustrate the results with numerical examples.

35 - Map Segmentation Algorithms for Geographic Resource Allocation
John Carlsson, Assistant Professor, University of Minnesota, Twin Cities, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, jcarlsso@umn.edu

In a wide variety of practical problems, a geographic region must be segmented into smaller regions to allocate resources "fairly". This is often done using combinatorial devices that discard the underlying geometry of the problem. In this session we describe a geometric framework, map segmentation, for solving such problems and give several examples demonstrating the effectiveness of such approaches.

36 - Decision Support System at AMD: OARS
Mehmet Candas, AMD, 5604 Southwest Pkwy, Austin, TX, 78735, United States of America, Mehmet.Candas@amd.com

The decisions support system Optimal Alignment and Review Systems is Advanced Micro Devices' tool for production planning in the extended AMD supply chain network that encompasses AMD owned production facilities and a collection of vendors contracted for production support and services in various geographies. The global macro production network consists of transportation links and production or processing nodes, with overlapping or distinct capabilities for capacity and multi-provisioning capabilities. While the primary objective of the problem is just in time fulfillment of demand, managing the product and process choices in manner which minimizes the amount of unusable by-products and levels of downgrading is a primary metric of solution quality within the applicable constraints. The biggest challenge in OARS project is to manage the size of the problem, considering millions of variables and constraints. We applied several segmentation strategies with multi-pass iterative solution processes, data pruning algorithms, pre-processing and post-processing methods to overcome this challenge.

37 - Workload Crisis Management in Knowledge-Based Service Systems
Yao Cheng, Northwestern University, 2121 Orrington Ave, Evanston, IL, 60201, United States of America, yaocheng2009@u.northwestern.edu, Wallace Hopp, Seyed Iravani

We propose a novel approach to model knowledge ñ assessment ñ decision process in hierarchically structured service systems that rely heavily on their agents' knowledge. We are able to show the decision properties under different assumptions, and to characterize the structural ability of such knowledge-based service systems to respond effectively to workload crisis.

38 - Informational Social Influences on B2C E-commerce Websites
Lih-Bin Oh, Assistant Professor, Xi'an Jiaotong University, 28 Xianning Xilu, Xi'an, China, ohlb@mail.xjtu.edu.cn

This study examines the persuasive social influence impacts of two forms of interpersonal information sources, namely third-party expert reviews and consumer-to-consumer electronic word-of-mouth (e-WOM) on B2C e-commerce Websites. Drawing upon persuasive argument theory and information integration theory, a laboratory experiment was designed to examine the impacts of message sidedness of third-party expert review and the valence of e-WOM.

Monday, 1:30pm - 3:00pm

■ MC01

C-Room 21, Upper Level

Joint Session DA/ MAS: Military Decision Analysis

Sponsor: Decision Analysis & Military Applications
Sponsored Session

Chair: Greg Parnell, United States Military Academy, Dept of Systems Engineering, West Point, NY, 10996, United States of America, Gregory.Parnell@usma.edu

1 - Risk Profiles and Rank Sensitivity in the Selection of a Course of Action in Stability Operations
Jeffery Weir, Associate Professor, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, jweir@afit.edu, Mary Sanders, Alex Gutman

Multi Objective Decision Analysis is a vital tool that can aid decision makers and take into account uncertainty and the effect of such on the ranking of Courses of Action. This research develops a framework for generating risk profiles as well as rank sensitivity charts to aid decision makers in course of action selection. An

example will be shown using stabilization operations in Iraq. This research is in support of the Air Force Research Laboratory's Commander's Predictive Environment.

2 - Assessing Progress in Counterinsurgency Operations
Paul Kucik, Academy Professor, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States of America, paul.kucik@usma.edu

In a counterinsurgency campaign, organizations develop strategic level assessments to measure progress towards goals and to inform resource allocation and policy decisions. Because insurgency is a complex, multi-disciplinary problem whose characteristics vary from one locality to the next, there are inherent challenges to developing assessments and recommendations for use at the strategic level. This presentation addresses those challenges and outlines possible solution approaches.

3 - Towards Blue Horizons
Greg Parnell, United States Military Academy, Dept of Systems Engineering, West Point, NY, 10996, United States of America, Gregory.Parnell@usma.edu

The Air Force Blue Horizons study used alternate futures and value-focused thinking to assess the future value of 58 future system concepts and 172 key enabling technologies. We describe the four scenarios and the decision analysis models. We highlight key conclusions and recommendations on how the Air Force should best prepare for such disparate potential challenges as rising peer competitors, the problem of failed states and continued insurgencies in far-flung parts of the world.

4 - Decision-focused Thinking: Early Successes and a Software Tool
Rob Dees, Analyst/Instructor, Department of Systems Engineering, United States Military Academy, US Army, Fourth Floor Mail Room, BLDG 752, Mahan Hall, West Point, NY, 10996, United States of America, rob.dees@us.army.mil, Alex MacCalman, Matt Dabkowski

At INFORMS 2008, we introduced Decision-Focused Thinking(DFT). At decision time, DFT eliminates common and unavailable value from a Value-Focused Thinking(VFT) model and showcases the value-based, alternative-refined, decision-relevant differences among the alternatives, thereby increasing understanding and commitment to action. In this presentation, we summarize early successes from practice with DFT and provide a preliminary software tool to automate the transformation and display of results.

■ MC02

C-Room 22, Upper Level

Behavioral Decision Making

Sponsor: Decision Analysis
Sponsored Session

Chair: Cade Massey, Asst Prof of Organizational Behavior, Yale University, School of Management, 135 Prospect St., New Haven, CT, 06511, United States of America, cade.massey@yale.edu

1 - Varieties of Loss Aversion and the Uncertainty Effect
Yuval Rottenstreich, Assc Prof of Management and Organizations, New York University, Stern School of Business, 40 West 4th St, #429, New York, NY, 10012, United States of America, yuval@stern.nyu.edu, Jeff Galak, Alex Markle

Uncertain prospect are often valued lower than their worst outcome. Such "Uncertainty Effects" may reflect loss aversion. Exchange loss aversion (ELA) arises when a sure thing is given up for another. Prospect loss aversion (PLA) arises when a sure thing is given up for a prospect. PLA > ELA implies uncertainty effects. We have subjects provide willingness-to-pay or certainty equivalents (only the former implicates loss aversion). We find Uncertainty Effects for WTP but not CE.

2 - Myopic Loss Probability Aversion
Thomas Langer, University of Muenster, Münster, D-48149, Germany, Thomas.Langer@wiwi.uni-muenster.de

For loss averse investors, a sequence of risky investments looks less attractive when evaluated myopically - an effect called myopic loss aversion (MLA). The phenomenon has been confirmed in several experimental studies. However, by the construction of the lotteries none of these studies can distinguish between MLA and an alternative explanation, myopic loss probability aversion (MLPA). We present the results of an experimental study that allows to disentangle these competing explanations.

3 - Keeping the Faith: Optimism in the Face of Feedback
Cade Massey, Asst Prof of Organizational Behavior, Yale University, School of Management, 135 Prospect St., New Haven, CT, 06511, United States of America, cade.massey@yale.edu, Joseph Simmons, David Armor

Does optimism persist in the face of feedback? To investigate we asked NFL fans to predict outcomes during each week of the football season. Participants were optimistic before the season began, predicting their favorite team would perform much better than did neutral parties. This optimism was very robust, persisting until the season's final weeks. By comparing our participants' responses to publicly traded prediction markets, we identify the critical role desirability plays in this bias.

■ MC03

C-Room 23A, Upper Level

Multicriteria Decision Making

Contributed Session

Chair: Jie Yu, Assistant Research Scientist, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States of America, yujie@umd.edu

1 - A Sequencing Model for Clients of a Liquefied Petroleum Gas Distribution Unit
Adiel Almeida-Filho, Assistant Professor, Federal University of Pernambuco, Rua da Hora, 593, Apto. B21, Espinheiro, Recife, PE, 52020-010, Brazil, atalmeidafilho@yahoo.com.br, Ana Paula Costa, Marcos Sobral

This work presents the context of a case study for this problem of sequencing clients using MCDA to consider traditional sequencing criteria and also strategic criteria which will refer specifically to the case study context, such as risk of lacks of gas in a specific region, distance between distribution unit and client last destiny and technical aspects of the operation.

2 - Student Project Allocation Using Goal Programming
Sydney Chu, Professor, University of Hong Kong, Department of Mathematics, Hong Kong, Hong Kong - ROC, schu@hku.hk

The student project allocation (SPA) problem assigns a list of projects to students with prerequisites. Students indicate preferences over eligible projects, while Department wishes to make the most allocations, with preferences for students of higher GPAs. These features lead naturally to a pre-emptive GP formulation, which generalizes from the typically single-objective SPA problems. A set of real data illustrates the effectiveness of its DSS implementation.

3 - Evaluating HCW Disposal Alternatives Using A Fuzzy Multi-criteria Decision Making Approach
Melis Almula KARADAYI, Galatasaray University, Ciragan Street No: 36 34357 Ortakoy, Istanbul, Turkey, melisalmula.sye@gmail.com

This paper presents a hierarchical distance-based fuzzy multi-criteria decision making framework for evaluating health-care waste (HCW) disposal alternatives for Istanbul, including "incineration"steam sterilization","microwave" and "landfill". Economic, environmental, technical and social criteria and their related sub-criteria, which incorporate both quantitative and qualitative data, are employed to evaluate health-care waste dipsosal alternatives.

4 - Flexible Flowshop Scheduling with Machine Skipping
Rasaratnam Logendran, Professor, Oregon State University, School of Mech., Indust.&Mfgr. Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, Logen.Logendran@oregonstate.edu, Vaibhav Pandya

We propose a methodology for minimizing the total weighted tardiness of jobs that are dynamically released in a flexible flowshop, with the possibility of machine skipping. Sequence dependent set-up of machines along with dynamic machine availabilities, further add to the complexity of the problem. The use of a tabu search-based heuristic algorithm for efficiently obtaining high quality solutions is demonstrated on an example problem.

5 - A Multi-criteria Approach for Prioritizing Traffic Safety Improvement Projects
Jie Yu, Assistant Research Scientist, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States of America, yujie@umd.edu, Yue Liu, Gang-Len Chang

This paper presents a multi-criteria approach for prioritizing traffic safety improvement projects, in which a set of criteria are selected to account for the impacts of technical, economic, and social related contributory factors. Results from a case study reveal that the proposed model is quite promising. Comparative study between the proposed and the existing methods has also been done to assist safety project managers in best understanding the unique features of the proposed model.

■ MC04

C-Room 23B, Upper Level

Online Auctions - Theory and Evidence

Cluster: Auctions
Invited Session

Chair: Wedad Elmaghraby, University of Maryland, R.H. Smith School of Business, College Park, MD, United State of America, Wedad_Elmaghraby@rhsmith.umd.edu

Co-Chair: Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@uiuc.edu

Co-Chair: Peter Popkowski Leszczyc, ppopkows@ualberta.ca

1 - Simultaneous Auctions by Sellers of Different Reputations: Theory and Experimental Evidence
Sarah Rice, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road, Unit 1041A, Storrs, CT, 06269, United States of America, sarah.rice@business.uconn.edu, Chris Dellarocas, Ravi Bapna

We study settings where vertically differentiated sellers (e.g. sellers of different reputations for honesty) simultaneously offer sealed-bid, second-price, single-unit auctions for identical goods to unit-demand buyers. Vertical differentiation is a salient but understudied aspect of wide range of simultaneous auction settings. We test our theoretical propositions in a controlled laboratory experiment with induced values.

2 - Optimal Auctioneer Fee Policy
Justin Jia, Penn State University, 483A Business Building, University Park, PA, 16802, United States of America, zuj100@psu.edu

In an online eBay-like auction, an auctioneer provides a platform for sellers to hold auctions and collects fees from them. The auctioneer and the sellers are not in the same revenue maximization party, as often assumed by classical auction theory. We formulate the problem as a Stackelberg game with a monopolistic auctioneer and a private-type seller, develop subgame perfect equilibria, and show that under certain conditions the auctioneer may use simple-form fees to achieve the best outcome.

3 - Measuring Risk Aversion in a Name-Your-Own-Price Channel
Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu, Il-Horn Hann

We measure the risk aversion coefficients exhibited by online bidders in a Name-Your Own Price (NYOP) intermediary. We present a decision analytic model for the optimal bidding sequence and relate the increments in each two successive bids to the bidders' risk aversion coefficient. We then use field data from an NYOP firm to estimate the exhibited risk aversion. Based on three different product groups, we find that that bidders exhibit relatively high risk aversion on internet sites.

4 - Jump Bidding in Online Auctions: A Double-Edged Sword
Peter Popkowski Leszczyc, University of Alberta, Edmonton, AB, Canada, ppopkows@ualberta.ca, Yongfu He

We develop a conceptual model of the opposing effects of jump bidding in online auctions. On the one hand, it may lead to reduced competition, by deterring bidder entry or discouraging continued bidding; leading to lower prices. On the other hand, it may signal a bidder's strength and/or high valuation, increasing willingness to pay (WTP). Results of two laboratory studies find support that jump bidding has both a deterrence of entry effect and a positive effect on bidders' WTP.

■ MC05

C-Room 23C, Upper Level

Panel Discussion: Research Issues and Opportunities in Homeland Security

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Associate Professor, Texas A&M University, 3131 MS, College Station, TX, 77843, United States of America, yuding@iemail.tamu.edu

Co-Chair: Gary Gaukler, TAMU, TAMU-3131, College Station, United States of America, gaukler@tamu.edu

1 - Research Issues and Opportunities in Homeland Security
Panelists: Henry H Willis, David Morton, Tayfur Altiok, Wilbert Wilhelm

A panel of leading researchers in the area of homeland security will discuss the current practice, research challenges and opportunities, and future directions in the field. In particular, the panel discussion will highlight how OR methodologies can affect policy making and contribute to making our nation safer. The panel members' expertise covers a wide range, from nuclear smuggling interdiction, port security, and sensor location optimization, to maritime security policy and risk analysis.

■ MC06

C-Room 24A, Upper Level

Quality and Statistical Decision Making in Health Care Applications II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing LiAssistant Professor, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, huiyang@eng.usf.edu

1 - Do Better Quality Hospitals Result in Better Patient Satisfaction and Recommendation Ratings?
Jiban Khuntia, PhD Student, Robert H. Smith School of Business, 4360 CHIDS Van Munching Hall, University of Maryland, College Park, MD, 20783, United States of America, jiban@umd.edu, Mahesh Kumar, Ritu Agarwal

This study investigates the effect of quality, technology capacity and staffing on patient satisfaction and recommendation ratings for hospitals. Using linear regression on data collected from 181 hospitals in California, we found that hospital's income and doctor-to-nurse ratio have positive impact on hospital ratings, whereas quality and technology capacity impacts are insignificant.

2 - The Impact of Clinical Documentation System: A Routines Perspective
Jie Mein Goh, University of Maryland, 3330 Van Munching Hall, Robert H Smith School of Business, College Park, MD, 20742, United States of America, jgoh@rhsmith.umd.edu, Ritu Agarwal, Gordon Gao

With the broad consensus on the potential benefits electronic medical records (EMR), the number of hospitals adopting EMR is expected to rise dramatically. Yet the uptake of EMR lags far behind these expectations. Less than 2 percent of the acute care hospitals in a recent survey have comprehensive EMR. Using a field study, we explore the impact of clinical documentation, a specific component of comprehensive EMR, in a pediatrics hospital. We present ways through which change to routines occur.

3 - Phase I Analysis for Performance Monitoring in Healthcare
Li Zeng, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, LZENG1@WISC.EDU, Shiyu Zhou

Outcomes in medical processes are important measures of care provider's performance. One key challenge in performance monitoring using outcomes is the need of adjustment for patient base-line risks. This study considers the Phase I analysis in risk-adjusted performance monitoring, which aims at identifying data from in-control process so that a reference can be established for future monitoring.

4 - Identification of Patient Recovery Patterns after Cardiac Surgery based on Laboratory Tests Results
Alcides Santander, USF - UniNorte, 4202 E Fowler Ave, ENB 118 - Industrial Eng. Department, Tampa, Fl, 33620, United States of America, asantand@mail.usf.edu, Jose Zayas-Castro, Peter Fabri, Ramzi Sinokrot

The aims of this research are to develop a comprehensive methodology for the analysis of laboratory test results to effectively monitor patient recovery process after undergoing cardiac surgery procedures. Time series clustering methods are applied to identify different patient recovery patterns that allow the detection of hidden interactions among different indicators of patient health condition and early identification of possible complications during patients' recovery.

■ MC07

C-Room 24B, Upper Level

Reliability Analysis for Design

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Martin WortmanProfessor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

1 - Reliability Modeling Supporting Decision-Based Design
Martin Wortman, Professor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

Reliability modeling finds one of its principal applications in the support of engineering design activity. Simulation has largely replaced operational prototyping of candidate designs; hence, reliability modeling of design alternatives is no longer driven by laboratory test-data. We offer a risk-based approach for determining when it is possible to identify the "most perferred" design alternative when reliability laws are difficulty to accurately capture.

2 - New Birnbaum Importance-based Heuristics for Solving Component Assignment Problems
Qingzhu Yao, University of Tennessee, 305 East Stadium Hall, Knoxville, TN, 37996, United States of America, qyao@utk.edu, Xiaoyan Zhu, Way Kuo

Given a system and a set of components with different reliabilities, the component assignment problem is to find an optimal arrangement of the components to the positions of the system so that the system reliability is maximized. Five new heuristics based on the Birnbaum importance are proposed and their properties are presented. Our extensive numerical tests demonstrate the effectiveness of the new heuristics. Finally, the suggestions on selecting appropriate heuristics for the CAP are made.

3 - Monitoring High-Dimensional Processes Using A Wavelet-Based Distribution-Free Tabular CUSUM Chart
Joongsup (Jay) Lee, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, gth689p@mail.gatech.edu, Seong-Hee Kim, James R. Wilson, Youngmi Hur

We formulate and evaluate WDFTC, a wavelet-based distribution-free tabular CUSUM procedure for detecting shifts in the mean of a high-dimensional process. We calculate the monitoring item from the discrete wavelet transform of the original process and apply the distribution-free CUSUM chart. Experimental results show that WDFTC outperforms existing multivariate process control charts in various types of multivariate test processes, including those with nonnormal marginals.

■ MC08

C-Room 24C, Upper Level

Applied Analysis of Patterns in Multi-source and Multivariate Data

Sponsor: Data Mining
Sponsored Session

Chair: Artur Dubrawski, Adjunct Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awd@cs.cmu.edu

1 - Integrating Experts Capabilities into Biosurveillance Systems
Taha Kass-Hout, Director, Global Public Health and Informatics, InSTEDD, 3303 Flowers Road South, #Q, Atlanta, GA, 30341, United States of America, kasshout@gmail.com

Over the last decade, the majority of the designs, analyses and evaluations of biosurveillance systems have been geared towards specific data sources and detection algorithms. Much less effort has been focused on how these systems will "interact" with humans. Our approach is designed to streamline the collaboration between domain experts and machine learning algorithms for detection, prediction and response to health-related events (such as a disease outbreaks or a pandemic).

2 - Network Analysis in Food Safety Investigations
Mark Huckabee, huckabeem@saic.com, Artur Dubrawski, Lynda Kelley, Karen Chen, Adrienne Dunham

In Food Safety Investigations, data such as sales receipts, shipping records, logs, and invoices, is being successively collected from multiple sources. Quickly understanding patterns in such data is a challenge for investigators. Our team has proposed the use of entity-link networks to represent the complex relationships among the products and manufacturers. Network-based visualizations and analyses improve understanding of data and allow investigators to more rapidly discover critical links.

3 - Recognizing Appliance-specific Patterns in Multivariate Time Series of Power-metrics From a Building
Mario Berges, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, marioberges@cmu.edu, Lucio Soibelman, Ethan Goldman, H. Scott Matthews

In this talk we will present different techniques for detecting and correctly identifying state-transitions for individual appliances in a building (e.g., a light-bulb going from state "off" to state "on"), by inspecting the overall voltage and current signals for the building's electrical distribution system. Specifically, we analyze estimates of the spectral envelope coefficients and explore how different statistical and machine learning tools can be applied to solve the problem.

4 - Adaptive Models for Recognition of Events in Temporal Data
Sajid Siddiqi, PhD Student, Carnegie Mellon University, NSH 3122, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, siddiqi@cs.cmu.edu, Artur Dubrawski, Abhishek Sharma, Julian Ramos

We describe a successful application of statistical machine learning to the problem of recognizing disparate events in time series. We use STACS, a state-of-the-art adaptive technique for learning Hidden Markov Model size and parameters. The trained models can reliably isolate events of various types in for instance acoustic recordings (such as human speech, animal sounds, vehicular noise, explosions, etc). It can also simultaneously handle data from multiple sensing modalities.

■ MC09

C-Room 25A, Upper Level

The Applied Probability Society Markov Lecture

Sponsor: Applied Probability
Sponsored Session

Chair: John Tsitsiklis, MIT, 77 Massachusetts Ave., Cambridge, MA, United States of America, jnt@mit.edu

1 - Information Aggregation and Consensus in Networks
John Tsitsiklis, MIT, 77 Massachusetts Ave., Cambridge, MA, United States of America, jnt@mit.edu

A primary function of many engineered and social networks is to aggregate the information obtained by the nodes of a network. We discuss a few of the models and thrusts that have been studied, starting with a model of "social learning" by rational (Bayesian) agents, and its connections with information fusion models in the engineering literature. We then consider a set of agents (processors, decision makers, sensors, etc.) who reach consensus through an iterative process involving the exchange and averaging of local values. We discuss a number of models, application contexts, and convergence results, and the connections with Markov chain theory.

■ MC10

C-Room 25B, Upper Level

Statistics

Contributed Session

Chair: Genady Grabarnik, Scientist, Ritesoft, 126 Brambach Rd, Hawthorne, NY, 10532, United States of America, genadyg@gmail.com

1 - Relationships Among Univariate Distributions
Yichun Chen, PhD Student, National Tsing Hua University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan - ROC, d937817@oz.nthu.edu.tw, Wheyming Song

This paper presents a user friendly display, in a matrix format, of a collection of 80 univariate distributions and their interrelationships. A simplified seven-by-five matrix, showing only 25 families, is designed for student use. These relationships provide rapid access to information that must otherwise be found from a time-consuming search of numerous sources.

2 - Comparison Assessment of Customer Associate Group Operation
Genady Grabarnik, Scientist, Ritesoft, 126 Brambach Rd, Hawthorne, NY, 10532, United States of America, genadyg@gmail.com, Yefim Michlin, Larisa Shwartz

Companies in the field of information technologies are characterized by high dynamicity in composition and profile of the customer associate groups. Assessment of the operation quality of these groups is a major factor in managing the communication process with the customers, and as such largely determines the company's success. The present study proposes a truncated sequential probability ratio test for the purpose in question.

■ MC12

C-Room 26A, Upper Level

Computational OR in Chronic Diseases

Sponsor: Computing Society
Sponsored Session

Chair: Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu

1 - Factor Screening: An Alternative Approach for Sensitivity Analysis

Reza Yaesoubi, PhD Candidate, North Carolina State University, Campus Box 7906, 421 Daniels Hall, Raleigh, NC, 27511, United States of America, ryaesou@ncsu.edu, Stephen Roberts

Factor screening experiments systematically examine the input factors of a model to identify those factors with significant effect on a selected output. We discuss how factor screening experiments can be employed as an alternative for sensitivity analysis. The advantages over traditional one- and multiple-way sensitivity analyses will be discussed. We will also review a number of available factor screening methods and present the results of applying them to a medical decision-making model.

2 - Optimizing the Timing of Statins for Patients with Uncertain Adherence

Jennifer Mason, N.C. State University, 375 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27613, United States of America, jemason2@ncsu.edu, Brian Denton, Steven Smith, Nilay Shah, Darin England

Statins are effective in reducing cholesterol, a primary risk factor for cardiovascular disease. However, patients who are prescribed statins often stop taking the drug altogether or take less than the prescribed amount, lowering the drug's benefit. We discuss an MDP model to optimize the treatment decision for hypercholesterolemia in the presence of uncertain future adherence. We present results for optimal policies in the presence of adherence improvement programs.

3 - Using POMDPs to Determine the Optimal Mammography Screening Schedule From the Patient's Perspective

Turgay Ayer, University of Wisconsin, 1513 University Ave., Madison, WI, 53708, United States of America, tayer@wisc.edu, Oguzhan Alagoz, Natasha Stout

Breast cancer is the second leading cause of cancer death among U.S. women. Mammography is the most common screening tool for breast cancer, yet there is no agreement over the optimal timing and screening frequency of mammography examinations. We develop a partially observable Markov decision process (POMDP) model for optimal mammography screening schedule from the patient's perspective. We derive several structural properties of the POMDP model. We optimally solve this POMDP using real data.

4 - Using Dynamic Models to Determine When to Stop Catch-Up Vaccination for Hepatitis B

David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

Hepatitis B is a vaccine-preventable chronic viral disease. In many locales, newborn vaccination for Hepatitis B is becoming widespread and officials are promoting catch-up vaccination programs as cost-effective public health interventions. Yet, due to increasing vaccination, infection incidence is slowly falling. We use models of disease transmission and progression to estimate how long these catch-up vaccination programs will remain cost-effective.

■ MC13

C-Room 26B, Upper Level

COIN-OR Open-Source Technology and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Matthew Saltzman, Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States of America, mjs@clemson.edu

1 - How COIN-OR is Helping Amadeus to Enhance Critical Applications

Daniel Perez, Amadeus, 485 Route Pin Montard, Sophia Antipolis, 06560, France, daniel.perez@amadeus.com

Amadeus is a leading company in the travel distribution market offering highly available and performing systems for critical missions. In such a demanding environment, the highest standards are required for any component to be ready for production. An application for airline operations using BCP has benefited from COIN-OR's multi-solver capability and modular framework. The benefits will be presented as well as lessons learned which could help to enhance COIN-OR.

2 - New CoinMP Release 1.5: A Simple C-API Windows DLL and Unix Solver Library (LP/MIP) Based on COIN

Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

The COIN Open Source Initiative has become very popular in the recent years. To make life easier for users that simply want to solve models and not compile C++ applications, we have developed a standard C-API Windows DLL CoinMP.DLL that implements most of the functionality of CLP, CBC, and CGL. A Linux/Unix version using AutoMake is also available.

3 - Using CHiPPS for Parallel Solution of Generic Integer Programs

Ted Ralphs, Lehigh University, ISE, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Yan Xu, Laszlo Ladanyi, Matthew Saltzman

In this talk, we discuss the application of the CHiPPS parallel search framework, which was designed specifically with support for the implementation of relaxation-based branch-and-bound algorithms in mind, to address the challenges that arise in parallelizing the branch-and-cut algorithm for solving generic mixed integer linear programs. We present computational results that illustrate the scalability of our approach and the tradeoffs inherent in parallelizing branch and cut.

4 - Modeling Cone Optimization Problems with COIN OS

Imre Polik, Visiting Assistant Professor, Lehigh University, Department of Industrial and Systems Engineering, 200 West Packer Avenue, Bethelehem, PA, 18015, United States of America, imre@polik.net, Jun Ma, Kipp Martin, Horand Gassman

We present a new modelling extension of the popular COIN OS, to model cone optimization problems. Not only this extension is able to represent a wide range of optimization problems, but it can also capture the special structure of them. This is crucial, since it enables the solvers to exploit these special structures to speed up the computation or to improve accuracy. This is joint work with Jun Ma, Kipp Martin and Horand Gassman.

■ MC14

C-Room 27A, Upper Level

Software for OR/MS III

Sponsor: Computing Society
Sponsored Session

Chair: Daniel Fylstra, President, Frontline Systems Inc., 913 Tahoe Blvd., #7, Incline Village, NV, 89450, United States of America, dfylstra@frontsys.com

1 - How to Assure a Successful OR Roll-out Using AIMMS?

Gertjan De Lange, AIMMS (Paragon Decision Technology), 5400 Carillon Point, Kirkland, WA, 98033, United States of America, Gertjan.de.Lange@aimms.com

How are you going to assure that the OR models you made and worked so hard on are actually used? Moreover, that they generate expected benefits and advance the organization continuously? This demo will focus on the ability to create and deploy OR into any organization using AIMMS. Based on real-life practices (i.e. AIMMS solutions used in businesses every day throughout the world), we will show you how to be successful from start to finish and cover all aspects of an OR roll-out.

2 - Pythagoras: An Agent-Based Model

Donna Middleton, Operations Research Analyst, Northrop Grumman, 12900 Federal Systems Park Drive, FP1/3122P, Fairfax, VA, 22033, United States of America, Donna.Middleton@ngc.com

Pythagoras is a modeling environment, providing the user with a host of capabilities, rules and behaviors to describe an agent. Pythagoras includes soft decision rules, dynamic sidedness and behavior-change triggers. Soft decision rules create instances of agents whose behaviors can be unique to the agent. Dynamic sidedness allows agents to change sides as a function of events and actions. Behavior-change triggers allow agents to change their behavior as a function of events or actions.

3 - Extending Stochastic AMPL to Represent Chance Constrained and Robust Optimization Problems

Christian Valente, CARISMA, Brunel University, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom, Christian.Valente@brunel.ac.uk, Viktar Zviarovich, Gautam Mitra

We propose extensions to AMPL modelling language to include chance constraints, integrated chance constraints, and robust optimization problems. This follows our earlier work on Stochastic AMPL (SAMPL) for scenario-based stochastic programming problems. We discuss the motivation, design issues and advantages of adding these extensions both from modelling and solution perspectives. We describe the implementation with examples of these new features in the SAMPL translator.

4 - Integrating Optimization, Simulation, and More in Risk Solver Platform for Excel

Daniel Fylstra, President, Frontline Systems Inc., 913 Tahoe Blvd., #7, Incline Village, NV, 89450, United States of America, dfylstra@frontsys.com

Risk Solver Platform for Excel is integrated software for Monte Carlo simulation, conventional optimization (upward compatible from the Excel Solver), stochastic optimization, and other decision models. With a unified user interface for building both optimization and simulation models, it aims to simplify learning, teaching, and use by non-specialists. It handles very large industrial models with excellent performance, makes maximum use of multi-core PCs, and supports 12 different Solvers.

■ MC15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - LINDO Systems, Inc. - Optimization Modeling Made Easy

Mark Wiley, LINDO Systems, Inc., 1415 North Dayton Street, Chicago, IL, 60622, United States of America, mwiley@lindo.com

LINDO Systems will demonstrate LINDO API, LINGO and WhatsBest their popular linear, integer, nonlinear and global optimization tools. Find out how easy it is to: quickly build complex optimization models; incorporate risk into your models; effortlessly access data in Excel and databases; seamlessly embed optimization into your own applications.

2 - IBM ILOG CPLEX 12 Technology Update

John Gregory, ILOG CPLEX Product Manager, IBM ILOG Optimization, 889 Alder, Suite 200, Incline Village, NV, 89451, United States of America, jgregor@us.ibm.com

Used by more than 1,300 commercial customers, IBM ILOG CPLEX is the world 's most trusted and widely used optimization software for mission critical applications. CPLEX 12 demonstrates IBM's commitment to IBM ILOG Optimization. Join us for an overview of the new performance and usability enhancements in CPLEX 12, which will allow you to solve models that are more realistic than ever.

■ MC16

C-Room 28A, Upper Level

Informational Impacts of the Internet

Sponsor: Information Systems
Sponsored Session

Chair: Nelson Granados, Assistant Professor of Information Systems, Graziadio School of Business, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu

1 - Product Uncertainty in Electronic Markets: Insights From eBay's Used Car Auctions

Paul Pavlou, paul.pavlou@temple.edu, Angelika Dimoka

The Internet interface poses a difficulty for buyers in evaluating products online, particularly experience goods, such as used cars. This increases product uncertainty, the buyer's estimate of the variance in product quality. However, the literature has ignored product uncertainty and focused on seller uncertainty. To address this void, this study examines the nature, effects, and antecedents of product uncertainty in online auctions for used cars.

2 - Measuring the Information in Information Work

James Short, Research Director, UC San Diego, 9500 Gilman #0519, La Jolla, CA, 92093, jshort@ucsd.edu, Adam Saunders

The growth of information workers in the US economy has been well documented. Wolff (2005) found that information workers increased from 37% of the work force in 1950 to 59% in 2000, to 63% in 2008. This session will present research on measuring the information in "information work". We will cover: (1) definitions of information (2) measuring information in the workplace (3) preliminary results (4) implications and future research.

3 - How Much Information? A Census of the Worlds' Data and Information

Roger Bohn, Professor, UC San Diego, 9500 Gilman Drive, San Diego, CA, 92122, United States of America, rbohn@ucsd.edu, James Short

The How Much Information (HMI?) research project is creating a 'census' of the worlds data and information for 2008. We depart from past measurements by attempting to count all data and information, including data generated by and for machines, and transient data that is created and thrown away, rather than being stored. We use bytes, words (Pool 1984), or hours as metrics. They give different implications about growth rates and relative importance of different kinds of information.

4 - Online Strategies for Information Age: Information Transparency in Business-To-Consumer Markets

Nelson Granados, Assistant Professor of Information Systems, Graziadio School of Business, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu, Alok Gupta, Robert Kauffman

The Internet increasingly enables firms to use information strategically by designing transparent, biased, distorted, and opaque selling mechanisms. However, the research on this topic is scarce and scattered across academic disciplines. We develop a research framework and a research agenda on the emerging and increasingly important topic of transparency strategy, which we define as the set of policies and decisions that a firm makes to disclose, bias, distort, or conceal market information.

■ MC17

C-Room 28B, Upper Level

New Models for eBusiness Channels and Online Product Review

Sponsor: e-Business
Sponsored Session

Chair: Daewon Sun, University of Notre Dame, 359 Mendoza CoB, Notre Dame, IN, 46556, United States of America, dsun@nd.edu

1 - Coordinating a Supply Chain with a Manufacturer-Owned Online Channel

Daewon Sun, University of Notre Dame, 359 Mendoza CoB, Notre Dame, IN, 46556, United States of America, dsun@nd.edu, Xuying Zhao, Jennifer Ryan

We consider a dual channel supply chain in which a manufacturer sells a single product to end-users through both a traditional retail channel and a manufacturer-owned direct online channel. We model each channel as a newsvendor problem, with price and order quantity as decision variables. In addition, the manufacturer must choose the wholesale price to charge to the independent retailer.

2 - The Effect of List Price on Channel Performance in a Revenue-sharing Contract

Jun Ru, PhD Candidate, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, jun.ru@utdallas.edu, Xiangpei Hu, Yunzeng Wang

Amazon.com, the leading online retailer, has designed a unique contract, called the Advantage Program, for managing its business relationship with suppliers. An important parameter in the contract is a list price that a supplier is allowed to choose for its product. We build a game theoretic model to show that supplier's list price acting as a constraint on retailer's retail price in the contract plays a major role in determining firms' decision and performance in equilibrium.

3 - Competing for Attention: An Empirical Study of the Strategic Behaviors of Online Reviewers

Wenqi Shen, Purdue University, 100 S. Grant Street, West Lafayette, IN, 47907, United States of America, shenw@purdue.edu, Yu Jeffrey Hu, Jacquelyn M. Rees

This study focuses on how online reviewers compete for the scarce resource, users' attention. We theorize the strategies that online reviewers could adopt to gain optimal attention under different conditions, such as the crowdedness of the review segment and the reviewer's reputation level. We found that reviewers would strategically choose different strategies in terms of choosing popular or unpopular books and posting extreme or moderate ratings under different conditions.

4 - Online Content Search and Creation Behavior Using Mobile Digital Media

Anindya Ghose, Assistant Professor, NYU Stern, 44 West 4th Street, New York, United States of America, aghose@stern.nyu.edu, Sang Pil Han

As mobile commerce becomes increasingly popular, newer strategies for mobile-based advertising and marketing may need to be implemented in this environment, in addition to or in lieu of, traditional internet marketing methods. Using both vector autoregressive and simultaneous equations models, we empirically estimate how content creation by users is related to their content usage in mobile media, and how these processes are related to the behavior of their social networks.

■ MC18

C-Room 28C, Upper Level

Advances in Computational Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Daniel Bienstock, Columbia University, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu

1 - Disjunctive Strong Branching Inequalities for Mixed Integer Nonlinear Programming (MINLP)

Mustafa Kilinc, Graduate Student, University of Wisconsin, 3226 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, kilinc@wisc.edu, Jeff Linderoth, Jim Luedtke, Andrew Miller

Strong Branching is an effective technique that can significantly reduce the size of branch-and-bound tree. We use "discarded" information from strong branching to create disjunctive cutting planes for convex MINLPs. These cuts can be strengthened by using optimality conditions and further by integrality of discrete variables. We show how Mixed Integer Rounding (MIR) and Mixing can be applied to Strong Branching Cuts. Computational results reveal that these inequalities might be effective.

2 - Approximating MINLP through Piecewise Linear Optimization

Ismael de Farias, Associate Professor, Texas Tech University, Lubbock, TX, 79409, ismael.de-farias@ttu.edu

We present a branch-and-cut strategy to solve mixed-integer nonlinear programming (MINLP) by approximating it as a piecewise linear optimizaiton problem (PLO). We make no assumptions on whether the nonlinear funcion is convex or not. We show how to derive new and efficient cutting planes for the PLO set, and we extend our results to the case where PLO includes a number of combinatorial constraints that often arise in MINLP.

3 - A New LP Algorithm for Precedence Constrained Production Scheduling

Mark Zuckerberg, BHP Billiton, Melbourne, Australia, Mark.Zuckerberg@bhpbilliton.com, Daniel Bienstock

We present a new iterative lagrangian-based algorithm for solving the LP relaxation of precedence constrained production scheduling problems as they occur in various industries. The algorithm can be proven to converge, and in practice we have found that even for problems with millions of variables and tens of millions of constraints, convergance is usually obtained in under 20 iterations, with each iteration requiring only a few seconds to solve with current computer hardware.

■ MC19

C-Room 28D, Upper Level

OD Estimation and DTA Model Calibration

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu

1 - Estimation of Network Origin-Destination Matrices Using Partial Link Traffic Flow Information

Shou-Ren Hu, Assistant Professor, National Cheng Kung University, No. 1, University Road, Tainan City, 70101, Taiwan - ROC, shouren@mail.ncku.edu.tw, Han-Tsung Liou, Srinivas Peeta

Inferring trip origin-destination (O-D) matrix in a vehicular network using partial link flow information is a crucial component for transportation planning and traffic management. Given the network structure, this study, addressed from a budgetary planning perspective, seeks to estimate a desirable network O-D matrix for network management purposes. A pseudo-inverse matrix method is proposed to solve the network O-D demand problem in an under-determined system.

2 - Origin-Destination and Speed Profile Calibration for Dynamic Traffic Assignment Models

Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Jorge Villalobos, Yang Gao

Most existing DTA calibration procedures focuses on origin-destination calibration with the goal of minimizing link count deviations without considering the situation in which the count may be resulted from either congested or free-flow conditions. We presented an integrated calibration methodology that optimizes the matching of both OD volumes and speed profiles through one-norm linearization of the least-square formulation and construction of demand curves.

3 - Estimation of Time-dependent OD Matrices Using Patial Static and Partial Dynamic Link Flow Data

Xiaoquan Liu, Rensselaer Polytechnic Inst., 2430 Bldg, 21st Street, Apt. 4, Troy, NY, 12180, United States of America liux12@rpi.edu, Satish Ukkusuri

We present a methodology to obtain time-dependent OD matrices, which is a required input for dynamic traffic simulation, using partial static and partial dynamic link flows information. The main focus is on the practical guidelines to obtain time depdent OD matrices using existing data.The approach is applied to the Manhattan, NY network to demonstrate the challenges and we provide recommendations for future applications.

■ MC20

C-Room 28E, Upper Level

Dynamic Programming

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Stephan Meisel, University of Braunschweig, Muehlenpfordtstr. 23, Braunschweig, Germany, Stephan.Meisel@tu-bs.de

1 - Approximate Dynamic Programming for Routing a Service Vehicle with Stochastic Customer Requests

Stephan Meisel, University of Braunschweig, Muehlenpfordtstr. 23, Braunschweig, Germany, Stephan.Meisel@tu-bs.de, Dirk Mattfeld

We present an Approximate Dynamic Programming approach to a dynamic vehicle routing problem with one vehicle and stochastic customer requests. Early requesting customers definitely request for service. Late request customers appear randomly over time. The goal is serving the maximum number of requesting customers within a fixed period of time. The performance of our approach is compared to the performance of a number of state-of-the-art waiting strategies and a greedy heuristic.

2 - A Bi-directional Resource-bounded Dynamic Programming Approach for the TSP with Time Windows

Jing-Quan Li, California PATH, University of California, Berkeley, Richmond, CA, 94804, United States of America, jingquan@path.berkeley.edu

This paper presents a bi-directional resource-bounded label correcting algorithm for the traveling salesman problem with time windows, in which the objective is to minimize travel times. Label extensions and dominance start simultaneously in both forward and backward directions. Our algorithm generates optimal solutions for a number of the instances with wide time windows for which no optimal solutions have been previously reported.

3 - The Traveling Purchaser Problem With Stochastic Prices

Seungmo Kang, University of Illinois at Urbana-Champaign, Room 1115, 1206 West Gregory Drive, MC-195, Urbana, IL, 61801, United States of America, skang2@illinois.edu, Yanfeng Ouyang

This research formulates an extension of the traveling purchaser problem where multiple types of commodities are sold at spatially distributed locations with stochastic prices. A purchaser's goal is to find the optimal routing and purchasing strategies that minimize the expected total travel and purchasing costs. We propose an exact solution algorithm, an iterative approximate algorithm and a greedy heuristic.

4 - Real-time Matching of Supply and Demand for Sustainable Passenger Transportation

Niels Agatz, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, nagatz6@isye.gatech.edu, Xing Wang, Alan Erera, Martin Savelsbergh

While ride-sharing is not new, the ubiquity of GPS-enabled cell phones has enabled practical dynamic ride-sharing. To exploit hardware capabilities, ride-sharing systems are needed to match up people for rides in ways that achieve both user and system objectives. In this research we develop a set of alternative control algorithms for such systems and study the characteristics of environments within which dynamic ride-sharing offers the greatest potential for emission and congestion reduction.

■ MC21

C-Room 30B, Upper Level

Advances in Network Flow Models II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Weihao Yin, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, alexyin@vt.edu

1 - A Graph Theoretic Formulation for Large Scale Single Destination Dynamic Traffic Assignment

Georgios Kalafatas, Purdue University, United States of America, gkalafat@purdue.edu, Srinivas Peeta

Recently, the authors presented a graph theoretic formulation for the single destination dynamic traffic assignment (SD-DTA) problem based on the CTM. In this study, we further improve its performance by moving from the cell level to the link level consistent with traffic flow theory. Computational experience from the Borman Expressway network in northern Indiana is presented.

2 - A Network Flow Algorithm for the Cell Based Single Destination Dynamic Traffic Assignment Problem

Hong Zheng, Ph.D., The University of Arizona, 1209 E 2nd St, Rm 206, Tucson, AZ, 85721, United States of America, hzheng@email.arizona.edu, Yi-Chang Chiu

We give a network flow algorithm for the cell based single destination system optimal dynamic traffic assignment problem.We show it equals the earliest arrival flow (EAF) then solve EAF on the time-expaned network. It is able to solve the case where backward wave speed is lower than the forward wave speed. The solution creates the same wave propagation effect with the cell transmission model, and avoids holding vehicles on the ordinary/merge connectors. Numerical examples show it outperforms LP.

3 - CTM-based Mathematical Program of the Dynamic Traffic Assignment under Incident Conditions

Weihao Yin, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, alexyin@vt.edu, Pam Murray-Tuite

This study develops a mathematical program model for DTA that encapsulates the Cell Transmission Model by constructing a time-expanded network. Allowing multi-destination flows, this work focuses on modeling network traffic evolution under incident conditions while complying with user equilibrium and retaining computational tractability.

■ MC22

C-Room 30C, Upper Level

Panel Discussion: The Industry Job Search

Cluster: Job Placement Service
Invited Session

Chair: Talisa Murray, systems analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu

1 - Industry Job Search

Moderator: Talisa Murray, systems analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu, Panelists: Anne Robinson, Stephen Strauss, Grace Lin, Krishna Jha

The panel will lead an informal discussion concerning the industry interview process, the appropriate steps to take during the job search, and the challenges that may be faced along the way. Time will be provided for questions and answers.

■ MC23

C-Room 30D, Upper Level

Joint Session MAS/SIM: DIME/PMESII Pt 4

Sponsor: Military Applications Society & Simulation
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - PMESII - LOE Metric Ontology for IW Analysis

Paul Works, TRADOC Analysis Center, 225 Sedgwick Avenue, Fort Leavenworth, KS, 66027, United States of America paul.works@us.army.mil, Stephen Black, Sarah Holden

This briefing outlines the TRAC-led development of a robust Irregular Warfare (IW) Analytic Capability. It specifically addresses the development of a PMESII - Line of Effort (LOE) Metric Ontology; how that Ontology will be used as a foundational product for analyzing how military and whole-of-government operations impact populations, and how such impacts can be measured and understood.

2 - Understanding Information Operations in Context of Irregular Warfare Using DIME/PmESII Simulation

Alok Chaturvedi, CEO, Simulex Inc., 3482 McClure Ave, Ste 120, West Lafayette, IN, 47906, United States of America, alok@simulexinc.com

We present several simulation experiments to assess how Information Operations shape population attitudes in four provinces of Afghanistan, Helmand, Ghazni, Herat, and Kabul. We represent the PmESII systems of Afghanistan in SEAS-VIS by five primitive constructs: Individuals, Organizations, Institutions, and Infrastructure. Within this environment we study Information Operations and the dynamic interplay between the environment, citizens, leaders, media, organizations and institutions.

3 - The National Operational Modeling Environment (NOEM)

John Salerno, Principle Computer Engineer, AFRL, 525 Brooks Rd, Rome, NY, 13441, United States of America, John.Salerno@rl.af.mil

NOEM is a stochastic system dynamics model representing a nation-state via a collection of interconnected regions. The NOEM allows users to forecast potential problem regions, test a wide variety of policy options, suggest suitable courses of actions given a set of initial conditions, and determine resource allocation methods that best improve overall national or regional stability. This presentation will provide an overview of NOEM, its current functionality and planned enhancements.

■ MC24

C-Room 30E, Upper Level

Manpower Modeling II

Sponsor: Military Applications Society
Sponsored Session

Chair: Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington, VA, 22207, United States of America, marie.hall@us.army.mil

1 - What is a Quality Soldier? A Multi-Attribute Model of Soldier Performance and Recruit Potential

Robert Dees, Major, US Army, Instructor/ORCEN Analyst, United States Military Academy, Department of Systems Engineering, Department of Systems Engineering, Mahan Hall, Room 306, West Point, NY, 10996, United States of America, Robert.Dees@usma.edu

The first paragraph of FM 1, The Army, states, "Only with quality Soldiers answering the noble call to serve freedom can the Army ensure the victories required..." All would agree that we want "Quality Soldiers," but what is one? We offer a model of "Soldier Performance" and statistical insights into "Recruit Potential" based on consultation in operational units. The intent is to measure what we want so that we can make better decisions related to the "Quality Soldier" in the future.

2 - Searching for Balance - Projecting Unit and Individual Time Between Deployments

Matt Dabkowski, Analyst/Instructor, Department of Systems Engineering, United States Military Academy, US Army, Fourth Floor, BLDG 752, Mahan Hall, West Point, ny, 10996, United States of America, matthew.dabkowski@usma.edu, Mark Zais

We develop a discrete event simulation that faithfully replicates the careers of the Army's infantrymen between 2014 and 2024. In particular, drawing on myriad data sources, regulations, and policies, we empirically answer the question, "Given 45 active BCTs, a 547.4K end strength, a sustained 16-BCT commitment in the GWOT, and ARFORGEN-Focused Manning, can the Army achieve a 1:2 deploy to dwell ratio for its active duty Soldiers?"

3 - Army Officer Force Profiles and Markovian Manpower Models

Andrew Hall, Assistant Professor, United States Military Academy, Department of Mathematical Sciences, 4760 N 40th Street, Arlington, VA, 22207, United States of America, andrew.o.hall@us.army.mil, Michael Fu

We model the Army officer manpower system as a mathematical program. The mathematical program is designed to minimize the absolute deviation from the Army's Personnel Manning and Authorization Document and to place smoothing controls on the spectrum of manpower decisions and controls. We explore the attainability and sustainability of Army force profiles. We propose a new network structure that incorporates both rank and years in grade to combine cohort, rank, and specialty modeling.

4 - The Army's Reliance on Stop Loss
Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington, VA, 22207, United States of America, marie.hall@us.army.mil, Andrew Hall

Stop Loss is an Army policy which requires Soldiers to remain in the Army beyond their contractual obligation in order to complete a unit's deployment to Iraq or Afghanistan. Stop loss was implemented to maintain unit cohesion and stabilize the force. We address projecting the quantity of soldiers in Stop Loss in the future, and analyzing strategies to eliminate the use of Stop Loss and the associated risks and costs that need to be mitigated when eliminated.

■ MC25

C-Room 31A, Upper Level

Improvements in Aviation Application

Sponsor: Aviation Applications
Sponsored Session

Chair: Rajesh Ganesan, Assistant Professor, George Mason University, 4400 Univ Dr. MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu

1 - Major Determinants of Aviation Environmental Impacts and Key Sensitivities
Terence Thompson, Metron Aviation, Dulles, VA, United States of America, terry@metronaviation.com

We discuss the major determinants of aviation impacts on the environment in terms of noise, air quality, and climate. We explore key sensitivities of these impacts to such factors as the level of flight activity, the distribution of flight demand, the composition of the fleet servicing the demand, and various types of environmental performance measures for aircraft in the fleet. The relative benefits of major policy options are also explored.

2 - Estimation of Taxi-out Time Using Approximate Dynamic Programming
Poornima Balakrishna, Ph.D. Candidate, George Mason University, 4400 University Drive, MSN 4A6, Fairfax, VA, 22030, United States of America, pbalakri@gmu.edu, Rajesh Ganesan, Lance Sherry

The primary objective of this research is to accurately predict taxi-out time of flights at major airports at least fifteen minutes before scheduled gate departure. This research presents a novel reinforcement learning based stochastic approximation scheme for predicting taxi-out times. The prediction problem is cast in a probabilistic framework of stochastic dynamic programming and solved using approximate dynamic programming approaches.

3 - Markov-based Models of Airline Customersí Online Search and Purchase Behaviors
Misuk Lee, PhD Student, Georgia Institute of Technology, mlee@gatech.edu, David Post, Laurie Garrow

This study analyzes how individuals search for information about air ticket attributes and prices using data from a website that sells tickets at low prices to travelers with a high degree of travel flexibility. Markov-based models are used to capture the dynamics of customers' searching and purchasing behaviors. Empirical results reveal that what visitors saw in previous site visits clearly influences future revisit and purchase probabilities, as well as search intensity within sessions.

■ MC26

C-Room 31B, Upper Level

Airport Operations and Competition

Sponsor: Aviation Applications
Sponsored Session

Chair: Scott Widener, University of Miami, 268 McArthur Engineering Building, University of Miami, Coral Gables, FL, 33124, United States of America, s.widener@umiami.edu

1 - Measuring Airport Efficiency With Fixed Asset Utilization
Scott Widener, University of Miami, 268 McArthur Engineering Building, University of Miami, Coral Gables, FL, 33124, United States of America, s.widener@umiami.edu, Murat Erkoc

Existing airport efficiency models are predicated upon analysis of each airport as a collection of assets, but do not take into account the utilization of these assets. This research focuses on a DEA model to look at how the assets are actually used by airports, both individually and collectively, to determine ways to improve the system with both operational improvements and capital investment by addressing the effects of both the on-time and delayed arrivals and departures.

2 - Parallel Aviation Agreements: Who Are They Good For?
Nicole Adler, Hebrew University of Jerusalem, Mount Scopus, Jerusalem, Israel, msnic@huji.ac.il, Eran Hanany

The simultaneous impact of frequency and price on consumer and producer surplus across hub-to-hub agreements has yet to be analyzed. Using a hybrid competitive-cooperative game theoretic framework, we compare competitive markets, bilateral agreements, codeshares and anti-trust immune alliances. The results suggest that competition does not always maximize social welfare on parallel links, contrary to current thinking, hence we present a model that allows governments to analyze specific markets.

3 - A Study on the Impact of Competition on Airport Congestion
Lavanya Marla, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge MA, United States of America lavanya@MIT.EDU, Niklaus Eggenberg, Cynthia Barnhart

Air transportation in the US is increasingly faced with the problem of airport congestion: airlines tend to over-schedule to attract market share and revenue. Unfortunately, the airlines share a limited resource - airport capacity. The underlying question we answer is whether competition can force the airlines to voluntarily adapt their schedules, due to high delay costs, thus reducing congestion, or if competition-regulatory measures by a central authority are required.

4 - Analysis of New York LaGuardia Airport Gate-Waiting Delays
Jianfeng Wang, George Mason University, 4450 Rivanna Ln # 3727, Fairfax, VA, 22030-4441, United States of America, jwang5@gmu.edu, John Shortle

Airport gates are one of the congestion points of the air transportation system. When an arriving flight lands on a runway, it is possible that it cannot pull into its gate due to gate unavailability. We define this phenomenon as gate-waiting delay. This paper gives a functional analysis of gate-waiting delays at New York LaGuardia airport.

■ MC27

C-Room 31C, Upper Level

Simulation in Health Care I

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Eva Enns, PhD Student, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu

1 - Understanding the Role of Family Doctors Using System Dynamics Simulationn
Evrim Didem Gunes, Koc University, Sariyer, Istanbul, Turkey, egunes@ku.edu.tr, Mehmet Cagri Dedeoglu

This work is motivated by the introduction of family practice in Turkey. The objective is to understand the expected changes in the behavior of patients and providers with this new system. System dynamics methodology is used to model patient flows, and to analyze the effect of introducing a gatekeeping system on the workloads for hospitals and for family doctors. Dynamics of service quality, word-of-mouth, referral rates, number of available family doctors are investigated with scenarios.

2 - Cost Effectiveness of the Vancouver Supervised Injection Facility
Greg Zaric, Associate Professor, Ivey School of Business, 1151 Richmond St N, London, ON, N6A3K7, Canada, gzaric@ivey.uwo.ca, Ahmed Bayoumi

Insite, a supervised injection facility, has operated in Vancouver, Canada, since 2003. We developed an epidemic model with 12 compartments representing all combinations of 4 infection categories and 3 behavior categories. We simulated for 10 years to estimate the incremental costs and health impact of the facility. The facility was either cost saving or had an incremental cost effectiveness ratio of less than $50,000 per life year gained under a wide range of scenarios.

3 - An Epidemic Model of HIV Treatment under Resource Constraints
Robert Koppenhaver, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, rzk9@pitt.edu, Andrew Schaefer, Mark S. Roberts

Antiretrovirals are the only treatment for HIV. In areas where HIV is prevalent, they remain a scarce resource. We consider a population of HIV+ patients in need of fixed number of antiretrovirals. We allow new patients to enter the population to account for the effects of epidemic growth. We evaluate the World Health Organization's treatment recommendations. We also model the problem as a dynamic program and evaluate the performance of treatment policies obtained from this model.

4 - Simulating the Spread of HIV through a Dynamic Sexual Partnership Network

Eva Enns, PhD Student, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu, Margaret Brandeau, Eran Bendavid, Thomas Igeme

We describe a microsimulation model of the spread of infectious disease over a dynamic contact network. Our model can be used to study the effect of network structure and dynamics on the spread of disease. To illustrate, we present a model of the spread of HIV over a dynamic sexual partnership network representative of the demographics and sexual behavior of Southern Africa. In particular, we use our model to study the impact of concurrent sexual partnerships on the HIV epidemic in this region.

■ MC28

H-Room 500, Fifth Floor

Web-driven RM Applications

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Assaf Zeevi, Professor, Columbia University, Graduate School of Business, Uris Hall, Room 406, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

1 - Revenue Maximization in Reservation-Based Online Advertising

ana radovanovic, Research Scientist, Google Inc, 76 Ninth Ave., New York, United States of America, anaradovanovic@google.com, Assaf Zeevi

In this talk we will describe a stylized model of the sales process in the reservation-based online advertising industry which is used for selling the premium ads. We formulate it as a constrained stochastic control problem with the objective of maximizing the long run revenue rate. The exact solution of this problem, is intractable and, instead, we propose a certain relaxation of this model which leads us to ways to design asymptotically optimal dynamic control policies.

2 - Optimal Auctions with Risk Averse Sellers

Mukund Sundararajan, Stanford University, 353 Serra Mall, Stanford, United States of America, mukous@gmail.com

Standard optimal (revenue maximizing) auction theory assumes that sellers are risk neutral. We begin to develop a parallel theory for risk-averse sellers.

3 - Optimal Dynamic Behavioral Targeting in on-line Advertising

Denis Saure, Columbia University, 3022 Broadway, Uris Hall, 4N, New York, NY, 10025, United States of America, dsaure05@gsb.columbia.edu, Assaf Zeevi

We study the problem of a publisher who selects ads to display to customers based on their profiles. By offering different ad bundles and observing ad-clicks, the publisher learns about consumer preferences. This experimentation, while incurring an immediate potential loss in revenues, should improve downstream ad customization and overall profits. We develop dynamic policies that balance these exploration-exploitation trade-offs and prove that their performance is best possible.

4 - Uncertainties in Allocation and Pricing in Ad Auctions

Hamid Nazerzadeh, Post-doc Researcher, Microsoft Research, One Memorial Dr, Cambridge, MA, United States of America, hamidnz@microsoft.com

Internet advertising is a market in which online service providers, such as search engines, sell the space on their webpages to advertisers. There are uncertainties about the quantity and quality of these advertisement opportunities. In this talk, I discuss some of the challenges caused by these uncertainties.

■ MC29

H-Room 501, Fifth Floor

Climate Change, Technology, and Policy

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu

1 - Climate Change Energy Technology R&D Portfolio Analysis

Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Senay Solak

We perform a portfolio analysis to get insights about the socially optimal R&D portfolio, and how it changes with increasing risk in climate damages. We implement data collected from expert elicitations on how government funding impacts the probability of success in three key climate change energy technologies — solar photovoltaics (PV), nuclear power, and carbon capture and storage (CCS). We use a Mixed Integer Non-linear Stochastic Program and do sensitivity over damage uncertainty.

2 - Solar Mapping and Economic and Emissions Benefits

Yihsu Chen, University of California, Merced, 5200 N. Lake Rd, Merced, CA, 95343, United States of America, yihsu.chen@ucmerced.edu, Qinghua Guo, Carlos Coimbra

One advantage of solar systems is their modularity that allows for distributed scale applications close to the load centers and for reduced costs of transmission compared to other renewable energy. We develop near real-time Global Horizontal Irradiance (GHI) and Direct Normal Irradiance (DNI) data for the California by blending satellite and ground-based measurements. We present preliminary results on potential fuel costs saving and emissions benefits based on empirical and modeling approaches.

3 - Stochastic Modeling of Endogenous Technological Change

Ekundayo Shittu, Tulane University, 7 McAlister Drive, New Orleans, LA, 70118, United States of America eshittu@tulane.edu, Volker Krey

We address an aspect of technological innovation, learning-by-doing, by exploring how uncertainties in learning rates impact social R&D investments into a range of energy technologies. We add stochastic learning to an existing model at IIASA through a cost-constrained risk-minimizing optimization model of the energy system. With uncertain learning, a prudent intermediate path of energy technology penetration is charted, and a more diversified technological portfolio is revealed.

■ MC30

H-Room 502, Fifth Floor

Forestry V: Wood-for-Energy Production Systems

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Feasibility and Climate Change Mitigation Potential of Large Scale Wood Bioenergy Production Systems

Catalin Ristea, Department of Forest Resources Management, University of British Columbia, Vancouver, BC, Canada, catalin.ristea@ubc.ca, Thomas Maness

This study is concerned with the economic feasibility of large scale wood-for-energy production systems and their effectiveness as environmentally sustainable climate mitigation strategies. Within a life cycle framework (that integrates a forest level model with biomass-to-bioenergy processing simulation modules) we estimate cost-benefit trade-offs and evaluate opportunities to reduce negative environmental impacts and achieve economic efficiencies.

2 - Feasibility of Managing Crown Fire Potential in California and Oregon via Targeted Thinning

Jeremy Fried, U.S. Forest Service, Pacific Northwest Research Station, Portland, OR, United States of America, jeremy.fried@fs.fed.us

The BioSum fuel treatment modeling system was applied to several thousand forest inventory plots representing a 21 million acre forested landscape following 23 policy scenarios covering diverse combinations of objectives, effectiveness expectations, and size-based constraints on tree removal. Product yield, area treated, bioenergy capacity and net revenue were all highly contingent on these and other scenario assumptions, such as whether revenues from product sales must cover treatment costs.

3 - Optimizing Monitoring of Ecological Indicators to Detect Climate Impacts in Boreal Forests

Tara Barrett, U.S. Forest Service, Pacific Northwest Research Station, Anchorage, AK, United States of America, tbarrett@fs.fed.us, Hans Andersen, Ken Winterberger

Optimization was useful for designing a monitoring system that could provide efficient estimates for five key ecological indicators: (1) total above-ground carbon in tree biomass; (2) presence of invasive vascular plants; (3) hardwood forest area; (4) mean stand age; and (5) basal area gross growth of Picea glauca. The method was applied to a 13.7 million hectare region of Alaska, with decision choices representing various combinations of field and remote sensing (lidar) plots.

■ MC31

H-Room 503, Fifth Floor

Competition in the Supply Chain

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Elodie Adida, University of Illinois at Chicago, 842 W. Taylor St., Chicago, United States of America, elodie@uic.edu

1 - Loss of Welfare in Oligopolistic Games: Application to Deregulated Electricity Markets

Georgia Perakis, Professor, Sloan School, MIT, 50 Memorial Drive Building E53-389, Cambridge, MA, United States of America, georgiap@MIT.EDU, Jonathan Kluberg

We study the performance of free competition in a market where some suppliers have a dominant position. We want to understand how much of society's welfare can be lost in deregulating a market that doesn't have a perfectly competitive structure (a large number of small suppliers). We apply our results to the analysis of electricity markets. We derive loss of welfare bounds for some of the traditional models of electricity supply competition, account for grid constraints.

2 - Competing for Shelf Space

Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States of America, guillaume.roels@anderson.ucla.edu, Victor Martinez de Albeniz

In this talk, we study the dynamics arising from the competition for shelf space. We consider a retailer that seeks to allocate its shelf space among different products to maximize its profit. To obtain larger shelf space allocations, product manufacturers can offer lower wholesale prices, thereby increasing the retailer's profit margin on their products. We characterize the competitive equilibrium arising from the scarcity of space and quantify the loss of efficiency.

3 - Channel Management in a Chain of Oligopolies

Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. Geroge Street, Toronto, ON, M5S3E6, Canada, ming.hu@rotman.utoronto.ca

We explore channel management of competitive suppliers selling through the same pool of competing retailers. In the existence of fierce competition due to high substitutability among suppliers' products or retailers' stores, vertical coordination through contracts by a supplier may fail to be a dominant strategy in a Stackelberg game where suppliers act as leaders to set wholesale prices and retailers act as followers to set retail prices.

4 - Efficiency and Coordination in a Supply Chain with Competing Manufacturers and Retailers

Elodie Adida, University of Illinois at Chicago, 842 W. Taylor St., Chicago, United States of America, elodie@uic.edu, Victor DeMiguel

We study competition in a supply chain where multiple manufacturers compete to supply a set of products to multiple risk-averse retailers who compete to satisfy the uncertain consumer demand. For the symmetric supply chain, we give closed-form expressions for the unique equilibrium. We also study (numerically) the asymmetric supply chain and its efficiency. Finally, we show how revenue-sharing contracts can be used to coordinate the decentralized symmetric chain.

■ MC32

H-Room 504, Fifth Level

Financial Engineering: Models and Statistical Analysis

Cluster: Financial Engineering
Invited Session

Chair: Steven KouProfessor, Columbia University, 312 Mudd, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States of America, sk75@columbia.edu

1 - A Model of Optimal Selling with Liquidity Constraint and Transaction Cost

Xin Guo, Associate professor, UC at Berkeley, Berkeley, United States of America, xinguo@newton.berkeley.edu, Mihail Zervos

In this talk, we present a model of selling stocks for big investors where aggressive selling will have negative price impact and conservative action will accumulate large transaction cost. We provide explicit solutions for the optimal selling strategy. Based on joint work with Mihail Zervos of London School of Economics.

2 - A Model for Electricity Spot and Futures Prices

Ning Cai, Assistant Professor, Department of IELM, HKUST, Hong Kong, China, ningcai@ust.hk, John Birge, Steven Kou

We propose a model for the on-peak electricity spot and futures price. More precisely, we model the logarithm of the scaled peak demand using two independent mean reverting affine (jump) diffusion processes, which describe different mean reversion structures of normal peak demands and spikes of demands separately, and then derive a model for the on-peak spot price based on the minimum Nash equilibrium for the demand-and-price function. Several advantages relating to our model are discussed.

3 - What is the True Cost of Active Management? A Comparison of Hedge Funds and Mutual Funds

Jussi Keppo, University of Michigan, 1205 Beal Avenue, Ann Arbor, United States of America, keppo@umich.edu, Antti Petajisto

On the surface, hedge funds seem to have higher fees than actively managed mutual funds. However, a mutual fund combines active positions with a passive position in the benchmark index, which can make the active positions expensive. A hedge fund takes both long and short positions and uses leverage, which makes the active positions cheaper, but this can be offset by the expected incentive fees. We investigate the tradeoffs between a mutual fund and a hedge fund for a range of parameter values.

4 - What Is a Good External Risk Measure

Xianhua Peng, Department of Mathematics and Statistics, York University in Toronto, 16 Aldwinckle Heights, Toronto, ON, M3J 3S6, Canada, xp2102@columbia.edu, Steven Kou

We point out that risk measures used for external regulation should have robustness with respect to modeling assumptions and data. We propose new data-based risk measures called natural risk statistics that are characterized by a new set of axioms based on the comonotonicity from decision theory. Natural risk statistics include VaR with scenario analysis as a special case and therefore provide a theoretical basis for using VaR along with scenario analysis as a robust external risk measure.

■ MC33

H-Room 505, Fifth Floor

Economic Models for Procurement Contract Design

Cluster: Economic Models in Operations Management
Invited Session

Chair: Sammi Tang, Assistant Professor, University of Miami, 5250 University Drive, Coral Gables, FL, 33146, United States of America, ytang@miami.edu

Co-Chair: Diwakar Gupta, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu

1 - Impact of Product Recall on Supplier Selection and Product Deployment

Max Shen, Professor, University of California-Berkeley, Dept of IEOR, Berkeley, CA, 94704, United States of America, shen@ieor.berkeley.edu, Ying Rong

Product recalls always cause big problems to firm's operations. The firm needs to not only deal with the logistics related to recalled products but also cope with damaged reputation. Therefore, the recalls affect both short-term and long-term profitability of the firm. In this talk, we provide a proactive strategy of integrating supplier selection and product deployment to reduce overall impact brought by product recalls.

2 - Flexible Contracts for Retail Supply Chains

Hao-Wei Chen, University of Minnesota, 111 Church Street S.E., Minneapolis, MN, 55455, United States of America, hwchen@ie.umn.edu, Diwakar Gupta, Haresh Gurnani

Retailers and suppliers need flexible supply contracts to reduce lost sales during stock out periods. However, too much flexibility can lower suppliers' profits. Moreover, consumers' response can affect each party's profits and the supply-chain fill rate. We compare three contracts when the retailer offers to fast-ship out-of-stock items to customers and characterize the relative benefit of various levels of contract flexibility on supply-chain performance.

3 - Buyer Preferences for Inventory Ownership and Placement in Developing the Negotiations Plan

M. Johnny Rungtusanatham, Carlson School of Management, University of Minnesota, Minneapolis, MN, 55455, United States of America, rung0002@umn.edu, Cynthia Wallin, Elliot Rabinovich, Yuhchang Hwang

We test hypotheses about buyer preferences for ownership and placement of inventory for an externally-sourced critical item. These preferences are typically articulated in the negotiations plan. The hypotheses tested relate specific transaction attributes to inventory ownership and placement preferences within

a buyer-supplier dyad. Data for the empirical test were collected from purchasing professionals in a role-playing experiment and analyzed using multinomial logistic regression.

4 - First Mover Advantage with an Intermediary and Information Asymmetry

Milind Sohoni, Indian School of Business, India, milind_sohoni@isb.edu, Jiri Chod, Sridhar Seshadri, Aditya Jain

We consider two firms, endowed with private and imperfect demand information, that sequentially decide their sale quantity and place orders with a common manufacturer. We study different information disclosure scenarios and address the question when it pays to be the first(second) mover. We analyze the factors that drive such benefit.

5 - Optimal Sourcing and Subsidy Policy When Suppliers Have Random Yield Loss

Sammi Tang, Assistant Professor, University of Miami, 5250 University Drive, Coral Gables, FL, 33146, United States of America, ytang@miami.edu, Haresh Gurnani, Diwakar Gupta

We consider a buyer whose suppliers are prone to random yield loss. The suppliers may improve yield by making a costly investment. The buyer, in turn, could submit a traditional order, provide a subsidy to cover a portion of the investment cost along with its order, or diversify by ordering from multiple uncorrelated suppliers. We characterize buyers' and suppliers' decisions and show how supply uncertainty affects investment and diversification strategies.

■ MC34

H-Room 520, Fifth Floor

Emergency Response/Humanitarian Logistics

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Ali Ekici, PhD Student, Georgia Institue of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, aekici@isye.gatech.edu

1 - Interactions of Infrastructure and Equitability in African Health Care Delivery

Jacqueline Griffin, Georgia Institute of Technology, Ferst. Dr., Atlanta, GA, United States of America, jgriffin3@gatech.edu, Martin Savelsbergh, Paul Griffin

Due to limited economic resources, sparsely located villages, and poor infrastructure the task of equitably distributing health care in Sub-Saharan Africa can be challenging. While incorporating the interactions between resource constraints, infrastructure, and settlement patterns, we examine the tradeoff between economic efficiency, health outcome, and equitability. Additionally we study the impact of investment in infrastructure on health care delivery and the efficient use of limited budgets.

2 - Three Central Stockpiles for 32 Million Beneficiaries: UNHCR's Inventory Challenge

Jessica McCoy, PhD Student, Stanford University, 377 Terman Engineering Center, Stanford, CA, 94305, United States of America, jhmccoy@stanford.edu, Margaret Brandeau

The United Nations High Commissioner for Refugees provides shelter and basic subsistence items to refugees and establishes and maintains refugee camps. UNHCR seeks to improve the timeliness and quality of disaster response. We develop a model to gain insights into appropriate shipment strategies and stockpile size for such operations.

3 - Routing and Scheduling for Medication Distribution Planning

Jeffrey Herrmann, University of Maryland, Department of Mechanical Engineering, 2181 Martin Hall, College Park, MD, 20742, United States of America, jwh2@umd.edu

In a public health emergency, officials must plan the logistics for distributing medication to points of dispensing (PODs). Our approach for solving the medication distribution problem separates the problem into two subproblems: (1) the routing problem assigns PODs to vehicles and creates routes for each vehicle, and (2) the scheduling problem determines when the vehicles should start these routes and how much material should be delivered on each trip.

4 - Real-time Applicability of Pandemic Modeling Approaches

Diana Prieto, University of South Florida, 4202 E. Fowler Ave, Tampa, Fl, 33620, United States of America, dprieto@mail.usf.edu, Alex Savachkin, Andres Uribe, Tapas Das

We present a systematic review of the existing research literature on pandemic influenza models for containment and mitigation. We examine how the approaches address: spatio-temporal structure and contact process, disease transmission, natural history, and intervention strategies. We also assess real-time applicability of the existing models as their capability to readily use demographic, social-behavioral, and epidemiological surveillance data, to generate dynamic mitigation strategies.

■ MC35

H-Sapphire A, Fourth Floor

Healthcare Operation Management

Sponsor: Health Applications
Sponsored Session

Chair: Shinyi Wu, Assistant Professor, Department of Industrial and Systems Engineering, University of Southern California, 3715, McClintock Ave, GER 240, Los Angeles, CA, 90007, United States of America, shinyi@rand.org

1 - Identifying Operational Challenges in Safety-net Operating Rooms

Sarah Kianfar, PhD Student, ISE Department, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, sarah.kianfar@gmail.com, Pai Liu, Yihan Xie, Shinyi Wu

Improving operating room (OR) services is imperative to ensure fiscal viability of and access to safety net hospitals. To identify prevailing concerns regarding OR efficiency, we used a unique dataset of proposals from 20 public hospitals applying for operational consultation. The concerns were coded using exploratory taxonomy guided by a literature review. Scheduling add-on cases, low compliance with scheduled time, and lack of operational standards are the most frequently mentioned problems.

2 - Improving Surgery Scheduling: Insights From Multi-site Management Engineering Consultations

David Belson, Adjunct Professor, ISE Department, University of Southern California, 3715, McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, belson@usc.edu, Shinyi Wu

We have studied surgery patient flow in 12 hospitals and found significant ways to increase utilization and benefit from scheduling. The software should include optimization and decision assistance that has an integer programming model identify improvements and a simulation validate. Actions are necessary to implement recommendations. Double booking and changing hours of operation can provide significant benefits. We recommend certain guidelines and tracking measures to assure productivity.

3 - An Implementation Framework Integrating Lean and Computer Simulation for Healthcare Improvement

Pai Liu, Graduate Research Assistant, ISE Department, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, pailiu@usc.edu, Shinyi Wu

Lean and computer simulation are two process improvement approaches increasingly used in health care system; each has their own advantages and limitations. We propose a synchronous implementation framework by integrating these two methods to reduce barriers for healthcare quality and process improvement projects.

4 - Workflow Study of an Electronic Referral System

Yihan Xie, Graduate Research Assistant, ISE Department, University of Southern California, 3715 McClintock Ave., GER 240, Los Angeles, CA, 90089, United States of America, yihanxie@usc.edu, Shinyi Wu

Access to specialty care has become an increasingly pressing issue for safety net settings. An e-referral system is developed to improve referring process to better utilize scarce specialist appointments. To assess its impact on the workflow of involved providers and on patient outcomes, we built a simulation model with data from an e-referral testing site. The simulation allows us to compare between traditional and e-referral systems and to identify strategies to improving the system.

■ MC36

H-Sapphire B, Fourth Floor

2009 Pierskalla Competition Papers II

Sponsor: Health Applications
Sponsored Session

Chair: Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - An Analysis of Pediatric Vaccine Formulary Selection Problems
Shane Hall, Assistant Professor of Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, shane.hall@afit.edu, Sheldon Jacobson, Edward Sewell

This presentation describes the General Vaccine Formulary Selection Problem for obtaining an optimal childhood immunization vaccine formulary with respect to economic costs and extraimmunization. Solution methods and computational results are presented and the trade-offs between alternative objectives are also discussed. This research allows public health policy makers and pediatricians to evaluate the combinatorial explosion of choices spawned by the development of combination vaccines.

2 - Adaptive Appointment Systems
Wen-Ya Wang, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, wenya@ie.umn.edu, Diwakar Gupta

We develop a framework for the design of the next generation of appointment systems that dynamically learn and update patient preferences and use this information to continuously improve appointment-booking decisions. We show that by using an adaptive approach, primary-care clinics can achieve a more robust performance in terms of their revenue and the goal of meeting patients' preferences for physician and time of day.

3 - Appointment Scheduling with Discrete Random Durations
Mehmet Begen, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, mbegen@ivey.uwo.ca, Maurice Queyranne

We determine optimal appointment schedule for a given sequence medical procedures/exams on a single processor (e.g., operating room, examination facility), to minimize the expected total underage and overage costs when each job has a random processing duration given by a joint discrete probability distribution. Our model can handle a given due date for the total processing (e.g., end of day for an operating room) after which overtime is incurred and, no-shows and some emergencies.

4 - When to Treat Prostate Cancer Patients Based on their PSA Dynamics
Mariel Lavieri, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Mariel.Lavieri@sauder.ubc.ca, William J. Morris, Scott Tyldesley, Martin Puterman

We model the decision of when to start radiation therapy in prostate cancer patients undergoing hormone therapy. Initial beliefs are based on population characteristics clustered by patient type. Using a dynamic Kalman filter model, patient specific estimates are updated as new information becomes available. Based on a cohort of intermediate risk patients, we show that our approach outperforms the current protocol by identifying earlier when radiation therapy should start in each patient.

■ MC37

H-Sapphire C, Fourth Floor

Supply Chain Coordination

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Doug Thomas, Penn State, 463 Business Building, University Park, PA, 16802, United States of America, dthomas@psu.edu

1 - Perishable Item Inventory Management and its Impact on the Bullwhip Effect
Sandra Transchel, Smeal College of Business, 461 Business Building, University Park, PA, 16802, United States of America, sxt37@psu.edu, Stefan Minner

An important element to operating a smooth flowing supply chain is to mitigate and preferably eliminate the Bullwhip Effect. Significant research has been done to understand causal factors that create supply chain oscillations for durable products. We analyze three replenishment policies for products with a limited shelf-life and its impact on the Bullwhip effect. Our particular focus is on lead time sensitivity, issuing policy (FIFO and LIFO), and lost sales and backorder assumption.

2 - On Dis-coordinating Contracts for Competing Supply Chains
Tong Wang, Assistant Professor, National University of Singapore, 1 Business Link, #03-31, Singapore, 117592, Singapore, tong.wang@nus.edu.sg

Two supply chains are competing in quantity in a market with uncertainty. Each supply chain consists of one manufacturer and one retailer. We study how the manufacturers should design the contracts to their downstream retailers to maximize their own profits. Specifically, we show that contracts coordinating the supply chains are not necessarily the optimal choice and that a dis-coordinated supply chain may gain competetive advantages against a coordinated one.

3 - The Transshipment Problem with Partial Lost Sales
Yale Herer, Technion - Israel Institute of Technology, Faculty of Industrial Engineering and Management, Haifa, 320000, Israel yale@technion.ac.il, Ella Dahan

We consider two cost-identical retailers which cooperate in a single period through transshipments in order to maximize joint profits. We consider the possibility that customers are not always willing to wait for transshipments; there exists a probability that a customer will return at the end of the period. Thus the number of returning customers is not known until after the transshipment decisions are made. The form of the optimal transshipment and replenishment policies is investigated.

■ MC38

H-Sapphire D, Fourth Floor

Supply Chain and Inventory Models

Cluster: Inventory Management
Invited Session

Chair: Alp Muharremoglu, Columbia University, Graduate School of Business, New York, United States of America, alp2101@columbia.edu

1 - Optimizing Strategic Safety Stock Placement in General Acyclic Networks
Sean Willems, Boston University, School of Management, 595 Commonwealth Ave., Boston, MA, 02215, United States of America, willems@bu.edu, Salal Humair

We present two enhancements to the guaranteed-service model for multi-echelon safety stock placement. First, we let each stage's expected inventory cost be a generalized non-concave non-closed form function of its incoming and outgoing service time. Second, we optimize the generalized cost model for directed acyclic networks. For the resulting NP-hard optimization problem, we present a provably optimal algorithm that runs within minutes for 29 chains from a data-set of 38 real-world chains.

2 - Assemble-to-order Systems with Exogenous Lead Times
Alp Muharremoglu, Columbia University, Graduate School of Business, New York, United States of America, alp2101@columbia.edu, Nan Yang

We study an ATO system with exogenous lead times under a component base stock policy. For the case of sequential lead times, we provide an efficient algorithm with polynomial complexity. We then proceed to develop efficiently computable upper and lower bounds for the general case of exogenous lead times, which includes i.i.d. and sequential lead times as special cases. We show that the bounds perform well numerically.

3 - Optimal Inventory Control in Market-Making with Risk Aversion
Miao Song, MIT, Cambridge, MA, 02139, United States of America, msong@mit.edu, David Simchi-Levi

Market-makers have the obligation to trade fixed amounts of assets at quoted bid or ask prices, and their inventories are exposed to the potential loss when the market price moves in an undesirable direction. One approach to reduce the risk associated with price uncertainty is to adjust the inventory at the price of losing potential spread gain. For a single-asset model, we show that a threshold inventory control policy is optimal for mean-variance analysis and exponential utility criterion. The mean-variance analysis for a multiple-asset model suggests that there exists a connected no-trade region and that the optimal strategy can be obtained from the no-trade region.

4 - The Final Order Problem for Repairable Spare Parts under Condemnation
Tarkan Tan, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Pav F7, Eindhoven, 5600 MB, Netherlands, t.tan@tue.nl, John van Kooten

We consider a manufacturer of complex machines that commits herself to repair failed spare parts throughout a service period. The suppliers of some spare parts discontinue production as technology advances and ask the manufacturer to place a final order. We address the final order problem for such repairable spare parts, which are subject to the risk of condemnation. We present a transient Markovian model and some approximations that allow us include further real-life characteristics.

■ MC39

H-Sapphire E, Fourth Floor

Operations Economics

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu

Co-Chair: Gabriel Weintraub, Assistant Professor, Columbia Business School, New York, NY, 10027, United States of America, gyw2105@columbia.edu

1 - Large-scale Service Marketplaces
Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Eren Cil, Achal Bassamboo

In this paper, we study the behavior of the agents and customers in a large-scale service market-place. Our main goal is to discuss the role of the moderating firm in facilitating information gathering, operational efficiency, and communication among agents. Surprisingly, operational efficiency may be detrimental to the overall efficiency of the market-place. We show that to reap the gains of operational efficiency the firm may need to complement it by enabling communication among its agents.

2 - Empirical Analysis of a Procurement Combinatorial Auction
Gabriel Weintraub, gyw2105@columbia.edu, Daniel Yung, Rafael Epstein, Marcelo Olivares

We conduct an empirical investigation of bidding data in a large-scale combinatorial auction, which provides useful insights to improve the mechanism design. Using a unique data set on the Chilean combinatorial auction for school meals, we develop an estimation strategy to identify features of the firms' cost structure and competitive behavior. We use this information to suggest improvements to the current allocation mechanism.

3 - Pricing and Quality in Expert Services
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, M. Fazil Pac

In expert service markets consumers do not know the correct type of service they need; hence they rely on experts to identify the correct type of service. Arriving customers decide whether to join the service queue based on their beliefs on the diagnosis, offered price and the resulting equilibrium delay. We study pricing incentives in such services created by information asymmetry.

4 - The Timing of Capacity Investment by Start-ups and Established Firms in New Markets
Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, swinney_robert@gsb.stanford.edu, Serguei Netessine, Gerard Cachon

It is often observed that disruptive innovations (improvements in products or services that drastically change the functionality, cost, or intended market) are often ignored or marginalized by established firms and brought to market by start-up firms. We show that these dynamics can arise as a natural consequence of the competitive interactions of fundamentally different firms rather than as a consequence of failure on the part of the established firm.

■ MC40

H-Sapphire H, Fourth Floor

Portfolio Management

Sponsor: Financial Services
Sponsored Session

Chair: Koray Simsek, Assistant Professor of Finance, Sabanci University, Orhanli - Tuzla, Istanbul, 34956, Turkey, ksimsek@sabanciUniversityedu

1 - Comparing the Risk-Adjusted Performance of Dynamic Asset Allocation Strategies
Koray Simsek, Assistant Professor of Finance, Sabanci University, Orhanli - Tuzla, Istanbul, 34956, Turkey, ksimsek@sabanciUniversityedu

In an economy with stochastic interest rates and stochastic volatility of equity returns, we compare the risk-adjusted performance of dynamic investment strategies including portfolio insurance. More specifically, we look at buy-and-hold, fixed-mix, constant-proportion portfolio insurance (CPPI) and various option-based portfolio insurance (OBPI) strategies. Risk aversion is introduced via standard utility functions or risk-measures such as Conditional Value-at-Risk (CVaR).

2 - Optimal Trade Credit Decisions of a Start-up Firm
Preetam Basu, Student, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States of America, preetam.basu@business.uconn.edu, Suresh Nair

n business-to-business (B2B) trade, selling on credit is the convention. However, when a firm sells on credit there is the risk of losing money as its customers can go delinquent. Aggressive selling on credit can hurt the firm adversely at times of customer delinquency. On the other hand, not granting credit to customers leads to lost sales. In this paper, we focus on the trade credit policies of a start-up firm under random demand and explore the managerial implications of these decisions.

3 - Optimal Decision Making with Stochastic Cash Flows
Wei Chen, SAS institute Inc, Wei.Chen@sas.com

For many financial institutions, future cash flows constitute major areas of financial uncertainty. Traditionally, the asset and liability management functionality in financial institutions is mostly concerned with the interest rate risk under the static cash flow assumption. With the continued development of global financial markets additional risks, such as credit risk and prepayment risk, have become more significant in cash flow analysis. The fact that these risk types are typically stochastic in nature represents a considerable challenge to the risk management in financial institutions. This paper presents an optimization model that provides an optimal asset and liability allocation, using institutional profitability as a target, with stochastic cash flows. At the same time, new demands for market- consistent valuation require financial institutions to better value instruments which are not actively traded in the market. This, in turn, has renewed interest in the classical idea of a "replicating portfolio," It utilizes proxies to match cash flow streams for such instruments. The optimal asset and liability allocation model is extended with a proxy selection technique that minimizes the approximation error.

4 - On the Role of Norm Constraints in Portfolio Selection
Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, jgoto@indsys.chuo-u.ac.jp, Akiko Takeda

We examine the role of norm constraints in portfolio optimization from several directions. First, it is equal to a robust constraint associated with return uncertainty. Secondly, combined with the VaR/CVaR minimization, a nonparametric theoretical validation is posed based on the generalization error bound for the nu-SVM. Through experiments, the norm-constrained tracking error minimization with a parameter tuning strategy outperforms the traditional models in terms of the out-of-sample error.

5 - Log-robust Portfolio Management with Derivatives
Ban Kawas, Lehigh University, 200 W Packer Ave, Bethlehem, 18015, United States of America, bhk206@lehigh.edu, Aurelie Thiele

We present a robust optimization approach to portfolio management under uncertainty that incorporates the imperfect knowledge on the true distribution of the continuously compounded rates of return, in the case where the decision-maker can invest in European call or put options in a static model. We present a tractable formulation, theoretical insights and numerical results, and compare the strategy with the setting where derivatives are not allowed.

■ MC41

H-Sapphire L, Fourth Floor

An Interactive Panel/Audience Discussion: From PhD to Junior Faculty - Challanges and Opportunities

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Gal Raz, University of Virginia, Charlottesville, VA, 22903, razg@darden.virginia.edu

1 - An Interactive Panel/Audience Discussion: From PhD to Junior Faculty - Challanges and Opportunities
Moderator: Gal Raz, University of Virginia, Charlottesville, VA, 22903, razg@darden.virginia.edu, Panelists: Carrie Queenan, Burcu Keskin, Atalay Atasu, Amy Cohn, Ramesh Johari

In this interactive panel discussion, we will discuss the challenges and opportunities in the transition from a graduate student working on a PhD to a new faculty member. Panel members will discuss their experiences in making this transition and dealing with the issues faced by junior faculty at the beginning of their career including managing the balance between teaching and research. The members of the panel come from diverse backgrounds and experiences in different environments including business schools and Engineering departments as well as domestic (US based) and international schools. A large part of the panel will be dedicated to interactive discussion with the Audience.

■ MC42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS
Invited Session

Chair: Allen Butler, President, Daniel H Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Hub Group Implements a Suite of OR Tools to Improve its Operations

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

Hub Group developed a production decision support system which integrated forecasting, error distribution analysis, expected value based heuristics and optimization. The system was structured to fit within Hub's existing organizational structure, business processes and information technology to reduce project risk, cost and operational disruption. Hub improved its performance by $11 million in cost savings in the system's first year, improved revenue per load and increased container velocity.

2 - Extending Bass for Improved New Product Forecasting

Karl Kempf, Intel Corporation, 5000 W. Chandler Blvd., MS-CH3-10, Chandler, AZ, 85226, United States of America, karl.g.kempf@intel.com, Asima Mishra, Berrin Aytac, David S. Wu, Shamin A. Shirodkar, Mehmet O. Atan

Forecasting demand for new products is increasingly difficult as the technology treadmill drives product lifecycles shorter and shorter. We present a model that perpetually reduces forecast variance as new market information is acquired over time. Our model extends Bass's idea of product diffusion to a more comprehensive theoretical setting using the notion of demand-leading indicators in a Bayesian framework. Successful implementation at Intel demonstrates not only improvement in time/efforts but also reduction in forecast errors that leads to significant cost savings.

■ MC43

H-Room 400, Fourth Floor

Joint Session Supply Chain Models/ Operations Management/Marketing Interface: Coordinated Pricing and Operations Management

Cluster: Supply Chain Models
Operations Management/Marketing Interface
Invited Session

Chair: Xin Chen, Assistant Professer, University of Illinois, Industrial and Enterprise Sys. Eng., Urbana, IL, 61801, xinchen@illinois.edu

1 - Coordinated Pricing and Inventory Management with Reference Price Effect and Deterministic Demand

Xin Chen, Assistant Professer, University of Illinois, Industrial and Enterprise Sys. Eng., Urbana, IL, 61801, xinchen@illinois.edu, Peng Hu, Simai He

We analyze a finite horizon coordinated pricing and inventory model in which demand at each period depends not only on the current price but also on past prices through reference prices. The firm's objective to maximize its total profit by designing a proper pricing and ordering plan. We develop strongly polynomial time algorithms to solve several special cases of this problem. For the general case, a heuristic is proposed with an error bound estimation.

2 - Coordinated Pricing and Inventory Management with Reference Price Effect and Stochastic Demand

Yuhan Zhang, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, United States of America, yzhang30@illinois.edu, Xin Chen

We analyze a single product periodic review model in which pricing and production/inventory decisions are made simultaneously. Demands in different periods are random and depend on not only the current selling price but also a memory-based reference price. Pricing and ordering decisions are made at the beginning of each period, and all shortages are backlogged. The objective is to maximize expected profit over either a finite horizon or an infinite horizon. We prove that a reference price dependent base-stock list price policy is optimal even though the single period expected profit may not be concave. In the infinite horizon case, we further show that in the optimal trajectory, reference price converges to a steady state and provide a characterization.

3 - On the Structure of Joint Inventory-pricing Control with Positive Leadtimes

Zhan Pang, Research Associate, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, zhan.pang@utoronto.ca, Youhua Chen, Youyi Feng

We consider the joint inventory-pricing control problem for a single-item inventory system with positive leadtimes and multiple outstanding orders. The system state consists of inventory level and a pipeline of outstanding orders. By using a transformation techique and the notion of L-natural concavity, we are able to partially characterize the structure of the optimal inventory and pricing policy. We also generalize our analysis to the cases of serial systems and stochastic leadtimes.

4 - Robust Pricing with Two Substitutable Products

Zhi-Long Chen, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@rhsmith.umd.edu, Ming Chen

We study a markdown pricing problem with two substitutable products. Given limited demand information, our goal is to find a robust pricing scheme over time so that the worst-case performance is optimized. We propose a dynamic programming approach which can find optimal solutions for two special cases in a reasonable amount of time. For a more general case, we propose an approximation scheme.

■ MC44

H-Room 402, Fourth Floor

Panel Discussion: Service Research & Innovation

Sponsor: Service Science
Sponsored Session

Chair: Kris Singh, Strategic Programs Director, IBM Research, IBM ARC, 650 Harry Road, San Jose, CA, 95120, United States of America, KrisSingh@us.ibm.com

1 - Service Science- What & How

Moderator: Kris Singh, Strategic Programs Director, IBM Research, IBM ARC, 650 Harry Road, San Jose, CA, 95120, United States of America, KrisSingh@us.ibm.com

Panel Chair: Kris Singh, President, SRII, Strategic Programs Director, IBM Research. Panel Members: Lori Brownell, General Manager, Microsoft; Ram Akella, Professor, UC santa Cruz, CA; Kate Johnson, VP, Service Engineering, Oracle Corp, CA

■ MC45

H-Room 410, Fouth Floor

The Role of Incentives and Behavior in New Product Innovation Projects

Cluster: New Product Development
Invited Session

Chair: Vish Krishnan, Professor, University of California, Rady School of Manageme, 9500 Gilman Drive MC 0553, La Jolla, CA, 92037, United States of America, vkrishnan@ucsd.edu

1 - The Effects of Implicit and Explicit Incentives on NPD Portfolio Selection

Stylianos Kavadias, Associate Professor, Georgia Institute of Technology, 800 W. Peachtree Street, Atlanta, GA, 30308, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Jeremy Hutchison-Krupat

A firm portfolio of new product initiatives is widely recognized as a key ingredient to the long-term success. However past research has overlooked an important aspect: defining a portfolio of initiatives can not be equated to choosing from a menu. We recognize that such initiatives are defined by and within the organization, and we shed light on how incentives (implicit and explicit), information asymmetry and the risk associated with the initiative, affect the resulting portfolio.

2 - Managing Projects with Present-Biased Agents

Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg, Karthik Ramachandran, Vish Krishnan

This study analytically examines the project team-level effects of a common individual bias in inter-temporal decision making, the present bias, which causes workers to leave more work for later completion. We develop key managerial insights about the magnitude and timing of project payments, constitution of the project team and the management of information asymmetry among such agents, and discuss the implications of our analysis and results for managers of different types of projects.

■ MC46

H-Room 411, Fourth Floor

Perspectives on Technology Development and Diffusion

Sponsor: Technology Management
Sponsored Session

Chair: Andrew Nelson, Asst Prof of Management, University of Oregon, Lundquist College of Buinsess, Eugene, OR, 97405, United States of America, ajnelson@uoregon.edu

1 - Antagonism, Aesthetics and Mimesis: The Institutional Failures of Aerodynamic Bicycle Technology

Ralph Maurer, Visiting Asst Professor, Freeman College of Business, Tulane University, 1817 Homer Street, Metairie, LS, 70005, United States of America, rmaurer@mac.com

This paper examines a failure of institutional entrepreneurship from the field of professional bicycle racing. I chart the introduction of new aerodynamic bicycle technologies over the last thirty years and the subsequent stifling by the international governing body for professional cycling, the Union Cycliste Internationale. Analysis reveals three social mechanisms that potentiate the failure of innovators to reshape institutions in their favor.

2 - Cognitive Flexibility: The Adaptive Reality of Concrete Organization Change

Nathan Furr, Assistant Professor, Brigham Young University, 660 TNRB, Provo, UT, 84604, United States of America, nfurr@byu.edu

The question of why some organizations change when others do not is of central interest. Recent case-based literature suggests cognitively flexible organizations are more likely to change. This study investigates the impact of three core constructs that contribute to cognitive flexibility.Ä'variety, novelty and framing,Ä'on when organizations change their technology. I examine these three constructs at the team and organization level on the likelihood of three degrees of technical change.

3 - Knowledge Diffusion, Technology Transfer, and the Challenge of Assessment

Andrew Nelson, Asst Prof of Management, University of Oregon, Lundquist College of Buinsess, Eugene, OR, 97405, United States of America, ajnelson@uoregon.edu

While "knowledge diffusion" is a popular topic, its study has been shaped by the conflation of "knowledge diffusion" with "technology transfer," particularly as the latter is concerned with engineering and science. In this paper, I present data showing that dominant operationalizations of diffusion through the limited lens of technology transfer obscure important diffusion channels, processes and influences, while altering perceptions of active individuals and organizational reach/impact.

4 - Breaking the Ivory Tower: Academic Entrepreneurship in the Life Sciences in UK and Germany

Jeannette Colyvas, Asst Professor, Human Development and Social Policy, Northwestern University, colyvas@sesp.northwestern.edu, Carolin Haessler

We examine engagement in commercial activities and different forms of technology transfer (consulting, patenting, and founding) among more than 2,200 German and UK life scientists. We test hypotheses that include attributes of individuals, their material and social resources, and perceptions about values and reputation. We find that characteristics reflecting the existing social structure of science are strong predictors for a greater breadth of participation in academic entrepreneurship, but not for all forms of technology transfer. Our findings also suggest that while, in practice, science and commerce go hand in hand, normative orientation still holds strong in shaping entrepreneurial involvement.

■ MC47

H-Room 412, Fourth Floor

Tutorial: Multiple Objective Decision Analysis Involving Multiple Stakeholders

Cluster: Tutorials
Invited Session

Chair: L. Robin Keller, Professor, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, LRKeller@uci.edu

Co-Chair: Jay Simon, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, Monterey, CA, 93940, United States of America, jrsimon@nps.edu

Co-Chair: Yitong Wang, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, YWang07@merage.uci.edu

1 - Multiple Objective Decision Analysis Involving Multiple Stakeholders

L. Robin Keller, Professor, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, LRKeller@uci.edu, Jay Simon, Yitong Wang

We show decision analysis techniques using spreadsheets to help understand the multiple objective perspectives of decision stakeholders. Sometimes, one objectives hierarchy suffices for all, so differences in opinions across stakeholders can be characterized by differences in weights on the multiple objectives. In other cases, an objectives hierarchy will be constructed for each stakeholder. This helps us identify mutually agreeable actions, design new actions, and foresee opposition.

■ MC48

H-Sapphire Green Room, Fourth

Operational and Financial Issues in Service Management

Cluster: Service Operations Management
Invited Session

Chair: Saravanan Kesavan, Assistant Professor, University of North Carolina, CB #3490, McColl Building, Chapel Hill, 27516, United States of America, skesavan@unc.edu

1 - The Impact of Device Standardization on Outcomes in Hip Replacement Surgery

Kamalini Ramdas, Professor, London Business School, kramdas@london.edu, Steven Stern, Haiyan Liu, Khaled Saleh

While component standardization has been researched a great deal in manufacturing settings, it is also applicable to services. In this paper we examine the impact of device standardization on outcomes in hip replacement surgery, using data from the University of Virginia Hospital.

2 - The Effect of Unit Managers on Unit Performance: A Longitudinal Study

Zeynep Ton, Harvard Business School, Morgan Hall 425, Boston, MA, 02163, United States of America, zton@hbs.edu, Dennis Campbell

How much do unit managers affect their units' operational and financial performance? Does the effect on performance differ for centralized versus decentralized organizations? We explore these questions by examining unit manager movements within multiple retail chains.

3 - Capacity Competition in Multi-indentured Service 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

We study a setting in which multiple firms providing different components of a product face investment decisions that impact after-sales service performance. In particular, each component provider can invest in either service capacity or spare parts inventory. A product-level service requirement demanded by the customer creates an externality among firms that drives strategic behavior. We contrast between the efficiencies of two commonly observed contracts under this environment.

4 - The Impact of Labor and Traffic on Store Performance

Olga Perdikaki, Assistant Professor, Texas A&M University, 4217 TAMU, College Station, 77843-4217, United States of America, operdikaki@tamu.edu, Saravanan Kesavan, Jay Swaminathan

We use proprietary data from a retailer to examine the impact of labor, intra-day traffic variability, and traffic uncertainty on two store performance measures: conversion rate and basket value. We find that increase in intra-day traffic variability is associated with a decline in conversion rate and basket value and increase in traffic uncertainty is associated with a decrease in conversion rate but not basket value.

■ MC49

H-Room 300, Third Floor

Workforce Scheduling in Call Centers

Cluster: Workforce Engineering and Management
Invited Session

Chair: Mehmet Yasin Ulukus, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, myu1@pitt.edu

1 - Optimal Balanced Control for Call Centers
Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl, Bernd Heidergott, Taoying Yuan, Dinard Laan, van der

Efficient workforce management needs to determine the scheduling and routing of calls simultaneously. This is a complex problem, especially when different customer classes have conflicting objectives. We look at mixtures of policies, which are known to benefit each individual customer class. We show that balanced sequences in combination with a stochastic gradient method outperform straightforward randomization of policies. The effectiveness is illustrated for a call center with call blending.

2 - Performance Models of a Single-skill Call Center
Oualid Jouini, Assistant Professor, Ecole Centrale Paris, Laboratoire Genie Industriel, Grande Voie des Vignes, Chatenay-Malabry, 92290, France, oualid.jouini@ecp.fr, Ger Koole

We consider a single-skill call center including abandonments. We focus on different service level definitions related to queueing delays. We show how these performance definitions, which are used in practice, can be modeled and calculated. We also gain additional insights from simulations.

3 - Dealing with Service Level Variability in Call Centers
Ger Koole, VU University Amsterdam, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, koole@few.vu.nl, Christian van Delft, Shuangqing Liao

Agent scheduling in call centers is done by solving a deterministic optimization problem, the only randomness is implicit in the Erlang formula. In this talk we discuss other types of randomness and discuss implications for agent scheduling.

4 - Agent Scheduling at Call Centers
Turgut Aykin, President, ac2 Solutions, 1090 King Georges Post Rd., Suite 305, Edison, NJ, 08837, United States of America, taykin@ac2solutions.com

This presentation provides a review of the approaches available for the agent scheduling problem at call centers. Complexities found in scheduling agents at large call centers are discussed together with the implications of skills-based routing. Computational results from several large call center organizations are reported.

■ MC50

H-Room 302, Third Floor

Hole in One: Using Operations Research to Analyze Golf II

Sponsor: SpORts
Sponsored Session

Chair: Douglas Fearing, MIT, Operations Research Center, Cambridge, MA, 02139, United States of America, dfearing@mit.edu

1 - Analyzing Situational Golfer Performance Using Putts Gained
Douglas Fearing, MIT, Operations Research Center, Cambridge, MA, 02139, United States of America, dfearing@mit.edu, Stephen Graves, Jason Acimovic

In an earlier talk, we developed a method of estimating putts-to-go and subsequently putts gained. In this talk, we utilize the putts gained metric to analyze situational golfer performance. First, we investigate the breakdown of on and off-green performance to demonstrate how different golfers pick up strokes. Next, we analyze putts gained across two situational slices of the PGA Tour's ShotLink data: putting for birdie vs. par and final round putting.

2 - Scramble Teams for the Pinehurst Terrapin Classic
Michael Ball, Robert H Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, mball@rhsmith.umd.edu, Russell Halper

The Pinehurst Terrapin Classic (PTC) is a 5-day, 16-player, annual golf tournament that includes both match-play and scramble rounds. We study how to create a schedule that ensures 1) that every pair of players is on the same team at least once and 2) that the teams are balanced. We are able to optimize team balance using a very compact integer program.

3 - Going for the Green: A Simulation Study of Qualifying Success Probabilities in Professional Golf
Richard Rendleman, University of North Carolina, Kenan-Flagler Business School, Richard_Rendleman@unc.edu, Robert Connolly

Each year, over a thousand golfers attempt to qualify for a PGA Tour card through Q-School. Our simulation model quantifies the probability that the Q-School correctly identifies high-skill golfers. We calibrate our model to account for variation in individual golfer skill over time and differences in skill across various groups of golfers attempting to qualify. We show that the very best players qualify, but players equal in skill to top-100 PGA Tour members have low odds of qualifying.

■ MC51

H-Room 303, Third Floor

Computational Optimization and Applications

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Yongpei Guan, Assistant Professor, Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - Computational Study on Lifted Cuts Using Multidimensional Superadditive Lifting Method
Bo Zeng, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, Fl, 33620, United States of America, bzeng@eng.usf.edu, Jean-Philippe Richard

Strong cutting planes could be obtained by applying multidimensional superadditive lifting method on multiple constraints. We present a set of computational results to demonstrate the effectiveness of those cuts on solving 0-1 mixed integer programs.

2 - Variable Space Exploration for NLP
John Chinneck, Professor, Carleton University, Department of Systems & Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca, Laurence Smith

Running a local NLP solver can be expensive. It is more efficient to first explore the variable space using inexpensive methods to find promising points from which to launch the local solver. We describe our recent work on voting and other social methods for choosing good NLP solver launch points.

3 - A Stochastic Programming Approach in Supply Disruption Management
Lei Zhao, Assistant Professor, Department of Industrial Engineering, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, lzhao@tsinghua.edu.cn, Ruiwei Jiang, Shanshan Guo

We explore the impact of supply uncertainty on production planning and model its mitigation solution as a stochastic program. We then study the trade-off between the cost of mitigation and the expected cost when supply disruptions may happen during the production.

4 - A Computational Study of the Maximum K-club Problem
Balabhaskar Balasundaram, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, baski.balasundaram@okstate.edu, Foad Mahdavi Pajouh

A k-club is an induced subgraph of diameter at most k. This defines a clique when k equals one. While every subset of a clique is also a clique, every subset of a k-club is not necessarily a k-club for k larger than one. This nonhierarchical property creates interesting challenges for optimization algorithms to find large k-clubs. This talk will outline these challenges, present a combinatorial branch-and-bound algorithm and a computational study of this problem.

■ MC52

H-Room 304, Third Floor

Marketing Strategies in Supply Chain Management

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Wenjing Shen, Assistant Professor, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, ws84@drexel.edu

1 - Lower Bounds and Heuristics for Supply Chain Allocation
Kai Rosling, Professor, Växsö University, TD, Växsö, SE-35195, Sweden, kaj.rosling@vxu.se, Johan Marklund

N retailers are replenished more often than their central warehouse. For large N, the stationary problem is optimized by zero warehouse safety stock and retailer order-up-to levels that decrease through the warehouse order cycle. Computations require feasibility on the average only, which creates a lower bound better than Clark&Scarf, except for small N. For finite N, the policy outperforms Jackson's (1988) stationary heuristic.

2 - Salesperson Compensation Scheme in a Supply Chain
Neda Ebrahimy, PhD Candidate, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, 60208, United States of America, neda@u.northwestern.edu, Hyo duk Shin, Mark Daskin, Seyed Iravani

We explore different salesperson compensation schemes in a supply chain with an upstream manufacturer and a downstream retailer. Investigating salesperson's incentive to put efforts to increase consumer demand, we demonstrate the impact of contracts between the parties within a supply chain on each firm's profits and total surplus.

3 - Strategically Sharing Demand Information in Competing Supply Chains
Hongtao Zhang, Associate Professor, HKUST, Clear Water Bay, Kowloon, Hong Kong - PRC, imhzhang@ust.hk

Two competing supply chains, each with a manufacturer and a retailer. A retailer conducts market research which may not be successful. If it is, the retailer can disclose the finding to its manufacturer. Uncertainty in market research enables a retailer to credibly conceal high-demand news. We consider the impact of research capability and retail competition. Less information is disclosed if retail competition is more intense. Retailers' market research capabilities are strategic complements.

4 - Examining Double Marginalization Effect for Innovative Products
Wenjing Shen, Assistant Professor, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, ws84@drexel.edu

Although double marginalization effect has been extensively studied, limited attention has been given to innovative products whose demand is generated through word-of-mouth effect. We study a supply chain that sells innovative products with pricing decisions and show that if profits are not discounted, then the supplier charges constant prices while retailer will dynamically change prices. Numerical results are provided to study the double marginalization effect under different settings.

5 - Examples Illustrating the Importance of Integrating Supply Chain and Revenue Management Activities
Peter C. Bell, Richard Ivey School of Business, University of Western Ontario, London, N6A 3K7, Canada, PBell@Ivey.ca

We examine two firms with traditional supply chain issues (excess capacity, high transportation costs, and highly seasonal demand) and show that these issues can be profitably resolved through marketing activities. We also show that management of these firms will likely make inappropriate strategic and tactical decisions unless their decision model includes both marketing and operations decision variables.

■ MC53

H-Room 305, Third Floor

Advances in Mixed Integer Programming II

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Santanu Dey, CORE, Louvain-La-Neuve, Belgium, Santanu.Dey@uclouvain.be

1 - Master Equality Polyhedron with Multiple Rows
Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca, Oktay Gunluk, Sanjeeb Dash

Master Equality Polyhedron (MEP) is a canonical set that generalizes the Master Polyhedron (MP) of Gomory and that can be used as a source of cutting planes for general mixed-integer programs and was recently studied for m=1 rows. In this work, we study the MEP when it is defined by m>1 rows. Unlike the MP, we show that a characterization of all facet-defining inequalities may not be as simple as when m=1. However, we show that separation can still be done efficiently in the cases m=2 and m=3.

2 - On the Relative Strength of Two Row Cuts for MILPs
Amitabh Basu, PhD Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15232, abasu1@andrew.cmu.edu, Gerard Cornuejols, Francois Margot, Pierre Bonami

Cutting planes generated from two rows of the optimal simplex tableau are of three types : splits, triangles and quadrilaterals. We compare the strength of these families of inequalities. We show that, in a well defined theoretical sense, triangle and quadrilateral inequalities provide a good approximation of the integer hull; whereas, the approximation produced by split inequalities may be arbitrarily bad. We will also give some experimental results showing the effectiveness of two row cuts.

3 - Flexible Isomorphism Pruning
James Ostrowski, University of Waterloo, jostrows@engmail.uwaterloo.ca, Jeff Linderoth, Francois Margot

Isomorphism Pruning is an extremely powerful symmetry breaking tool when applied to integer programs. However, Isomorphism Pruning has the limitation that the algorithm must use a restricted choice of branching variables during the search. In this talk, we show how remove this limitation—-modifying isomorphism pruning to allow for complete flexibility in the choice of branching variable. Computational results showing the benefit of this flexibility will be given.

4 - Decomposition of Multi-Period MIPs with Approximate Value Functions
Alejandro Toriello, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, atoriello@gatech.edu, George Nemhauser, Martin Savelsbergh

We investigate the possibility of generating good solutions to multi-period MIPs by solving single- or few-period subproblems linked by state variables. The tailing-off effect of shorter planning horizons is mitigated by a piecewise-linear concave approximate value function obtained via sampling and data fitting.

■ MC54

H-Room 306A, Third Floor

Online Optimization Problems

Sponsor: Optimization/Networks
Sponsored Session

Chair: Niv Buchbinder, Microsoft Research, 1 Memorial dr., Cambridge, MA, 02142, United States of America, nivbuchb@microsoft.com

1 - The Adwords Problem: Online Keyword Matching with Budgeted Bidders under Random Permutations
Nikhil Devanur, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States of America, nikdev@microsoft.com

We consider the problem of a search engine trying to assign a sequence of search keywords to competing bidders, each with a daily budget. The sequence of bids is revealed on-line. The goal is to maximize the revenue. If the keywords arrive in a random order, then we present an algorithm with a competitive ratio of 1-epsilon under some mild, but necessary, assumptions. In contrast, if the keywords arrive in an adversarial order, it is known that the best CR is bounded away from 1.

2 - Making Decisions: A New Technique
Jacob Abernethy, PhD Student, University of California at Berkeley, 387 Soda Hall, Berkeley, CA, 94720, jake@cs.berkeley.edu

To a large extent, there has been a significant divide between the online learning community and the online algorithms community. The Paging problem, as well as the related Metrical Task Systems problem, has generally been approached very differently than, for example, the problem of "competing with the best expert". I'll show a new technique, "Guess the Futureto solve the Paging and Experts problem optimally, and I'll conjecture that the approach is indeed much more general.

3 - Caching Problems - Online Algorithms Meet Linear Programming
Niv Buchbinder, Microsoft Research, 1 Memorial dr., Cambridge, MA, 02142, United States of America, nivbuchb@microsoft.com, Nikhil Bansal, Seffi Naor

We consider online algorithms for the generalized caching problem. Here we are given a cache of size k and pages with arbitrary sizes and fetching costs. The goal is to minimize the total cost of fetching the pages into the cache. We give an online algorithm with competitive ratio $O(\log^2k)$. We also give improved $O(\log k)$-competitive algorithms for several interesting special cases of the problem. Our algorithms are based on a novel primal-dual framework for online algorithms.

■ MC55

H-Room 306B, Third Floor

Procurement and Risk Management in Commodity Markets

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

1 - Inventory Control of Seasonal Storage Assets: Maximizing the Value of Limited Flexibility

Owen Wu, Assistant Professor, Ross School of Business, University of Michigan, Ann Arbor, owenwu@umich.edu, Derek Wang

The value of seasonal storage depends on both the seasonal commodity price and the operational flexibility. We characterize the optimal injection and withdrawal strategy for a natural gas seasonal storage. We find some counter-intuitive policies are actually optimal, e.g., even if the expiring futures contract price is the lowest on the forward curve and all futures prices are martingales, it might still be optimal to delay a portion of injection to capture the value of operational flexibility.

2 - An Approximate DP Approach to Benchmark Practice-based Heuristics for Natural Gas Storage Valuation

Guoming Lai, McCombs School of Business, University of Texas, Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, guomingl@andrew.cmu.edu, Nicola Secomandi, Francois Margot

The valuation of the real option to store natural gas is a practically important problem. Traders value this option heuristically because its exact valuation is at odds with the high-dimensional price evolution models that they use. We develop a novel and tractable approximate dynamic programming method that coupled with Monte Carlo simulation computes lower and upper bounds on the value of storage. We use these bounds to benchmark heuristics used in practice.

3 - Supply Management for Proportional Product Markets

Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

Traditional (B2B) contracting models consider single homogenous product model where a single unit of input is processed to produce a single unit of output. In many commodity markets (such as fed-cattle, soybeans), one unit of input (beef) is processed to produce proportional amounts of multiple-outputs. We investigate the implications of the proportional product model on the optimal mix of long-term and short-term (spot) contracting decisions.

■ MC56

H-Room 307, Third Floor

New Trends in Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Angelia Nedich, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, angelia@illinois.edu

1 - Testing the Nullspace Property Using Semidefinite Programming

Alexandre d'Aspremont, Princeton University, Dept of Operations Res & Fin Eng, Princeton University, Princeton, NJ, 08544, United States of America, aspremon@princeton.edu, Laurent El Ghaoui

Recent results in compressed sensing show that, under certain conditions, the sparsest solution to an underdetermined set of linear equations can be recovered by solving a linear program. Given a matrix A, we use semidefinite relaxation techniques to test the nullspace property on A and show on some numerical examples that these relaxation bounds can prove perfect recovery of sparse solutions with relatively high cardinality.

2 - Sparse Solutions of Standard Quadratic Programmimng Problems with Random Matrices

Jiming Peng, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, pengj@illinois.edu

In this talk, we investigate the properties of the solutions of the so-called standard quadratic programming problems (StQP), which has been proved to be NP-hard. Motivated by the recent results in compressed sensing, we focus on the scenarios where the associated matrix is random. We show that if all the elements of the underlying matrix follow i.i.d., then the corresponding StQP has a very sparse solution with a high probability.

3 - Online Learning and Interior Point Algorithms for MDPs with Expected Budget Constraints

Constantine Caramanis, The University of Texas at Austin, Austin, TX, cmcaram@ece.utexas.edu, Nedialko Dimitrov, David Morton

An MDP with n states can be solved using the value iteration algorithm in O(n^2) time, as opposed to the Omega(n^3) time required if one uses a linear program. Expected budget constraints on the MDP policy can be easily captured in a linear program formulation, but break the basic value iteration algorithm. We show two new algorithms for solving MDPs with k budget constraints giving the exact solution in O(poly(k) n^2) time or an approximately feasible solution in O(log(k) n^2) time.

4 - Distributed Asynchronous Stochastic Optimization Method

Angelia Nedich, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, angelia@illinois.edu

We consider a distributed method over a network for optimizing a convex objective function, which is known to all agents in the network. At any given time, one agent updates and passes its estimate to one of its neighbors according to a Markov chain distribution. We consider a gradient-based scheme, and establish some convergence properties and error bounds on the performance.

■ MC57

H-Room 308, Third Floor

Health Information Technology and Organization Transformation

Sponsor: Health Applications
Sponsored Session

Chair: Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

1 - Alert Management in Electronic Medical Record System

Amanda Mejia, Graduate Research Assistant, Georgia Institute of Technology, 609 Virginia Ave NE #4104, Atlanta, GA, 30306, United States of America, mandy.mejia@gatech.edu, Eva Lee

This work focuses on analyzing EPIC alert data to identify opportunities to filter medication alerts in order to reduce alert fatigue and improve quality of care. Our analysis will focus on 6 months of data to characterize types of alerts and recommend potential filters for alerts reduction. Validation of the benefits of these filters will be tested. This project is led by Dr Lee with collaboration with clinical leaders from Children's HealthCare of Atlanta.

2 - Absorptive Capacity for Transformative Initiatives in Two Health Systems

Bita Kash, BAKASH@SRPH.TAMHSC.EDU, Aaron Spaulding, Christopher Johnson, Larry Gamm

The paper reports on development of a research framework and measurement model of absorptive capacity (ACAP) for transformations in healthcare systems. Tapping ACAP via a survey for organizational participants—administered before, during, and after a transformation effort— will examine a two-way relationship between ACAP and current and future transformations.

3 - Reducing Medication Error

Deniz Cinalioglu, Grad Student, Georgia Tech, Atlanta, GA, 30332, dcinalioglu3@gatech.edu, Hyojung Kang, Eva Lee, Sudhan Chinnappan

In this talk, we will focus on high alert medication administration. Medication process flow in 3 units across two hospitals will be described. Reports on time-motion study on the administering process, and simulation of the medical process will be presented. Potential intervention and mitigation strategies will be analyzed. This project is led by Dr. Lee with collaboration with clinical leaders from Children's HealthCare of Atlanta.

4 - Multi-Project Mapping in Organizational Transformation: Cross Project Interdependency Mapping and Differential Dependence on Organizational Technologies in Two Health Systems

Larry Gamm, Gamm@srph.tamhsc.edu, Bita Kash, Christopher Johnson, Aaron Spaulding

The paper present a mapping model of interdependencies among multiple transformation projects within two large health systems, assessing the relative reliance of projects and their interdependencies upon four organizational technologies. The research relies primarily upon approximately 60 interviews containing both narrative and numeric responses to standard interview items.

■ MC58

H-Room 309, Third Floor

Models and Solutions for Logistics and Scheduling

Cluster: Scheduling
Invited Session

Chair: Chung-Lun Li, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China, lgtclli@polyu.edu.hk

1 - Repairable Inventory Optimization of an Item with New and Warranty Demand Sources

Yizhong Lin, The Chinese University of Hong Kong, SEEM Dept, CUHK, Shatin, Hong Kong, Hong Kong - PRC, yzlin@se.cuhk.edu.hk, Janny Leung

We consider a multi-period single-product repairable inventory problem. We concern issues on perfect substitution of instantaneous supply sources (purchasing new and repairing returns), demand (new and warranty) priority and relationship between warranty demand and repairable returns. We prove the optimal replenishment and disposal policies raised by Simpson (1978) still hold.

2 - An Improved Approximation Algorithm for Multiple Depot Traveling Salesman Problem

Zhou Xu, Assistant Professor, The Hong Kong Polytechnic University, lgtzx@inet.polyu.edu.hk, Brian Rodrigues

We present an improved approximation algorithm for an important extension of the classical traveling salesman problem (TSP), with multiple vehicles located at multiple depots. Our approximation algorithm runs in polynomial time when the number of depots is a constant, and achieves a performance ratio of 3/2, which is the best ratio that one can expect unless the classic TSP has an approximation algorithm superior to the well-known Christofides heuristic.

3 - A Fast Preemptive Scheduling Algorithm with Release Times and Inclusive Processing Set Restrictions

Joseph Leung, Distinguished Professor, New Jersey Institute of Technology, Department of Computer Science, Newark, NJ, 07102, United States of America, leung@oak.njit.edu, Yumei Huo, Xin Wang

We consider the problem of preemptively scheduling n jobs on m machines so as to minimize the makespsn. Each job has a processing time and an eligible machine set. The eligible machine sets are inclusive. We give an $O(nk \log P + mk^2 + m^3k)$-time algorithm, where k is the number of distinct release times and P is the total processing time of all jobs.

4 - Polyhedral Analysis of an Evacuation Planning Problem

Emrah Cimren, The Ohio State University, Integrated Systems Engineering, 1971 Neil Ave, Columbus, OH, 43210, United States of America, cimren.1@osu.edu, Marc Posner

We consider the polytope of an inequality with continuous and binary variables with upper bounds. This polytope arises as a sub-problem of large scale MIP models of real life problems such as railroad scheduling and evacuation planning. The polyhedral structure of the convex hull of the polytope is investigated. We introduce a family of facet-defining valid inequalities and develop a sequence independent lifting procedure.

■ MC59

H-Room 310, Third Floor

Tutorial: Innovation and Product Development

Cluster: Tutorials
Invited Session

Chair: Christian Terwiesch, Professor, The Wharton School, 548 JMHH, Philadelphia, PA, 19104, United States of America, terwiesch@wharton.upenn.edu

1 - Innovation and Product Development

Christian Terwiesch, Professor, The Wharton School, 548 JMHH, Philadelphia, PA, 19104, United States of America, terwiesch@wharton.upenn.edu

This tutorial establishes a problem solving framework to product development. Taking this perspective has at least two advantages. First, the problem solving view is sufficiently general that it allows us to abstain from favoring any one of the many existing academic disciplines associated with product development. Second, the problem solving view will reveal many similarities between the existing literature streams and point to fruitful areas of future research.

■ MC60

H-Room 311, Third Floor

The Rise and Fall and Rise Again of Interior-Point Methods

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Margaret Wright, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, 10012, United States of America, mhw@cs.nyu.edu

1 - Then and Now: The Renaissance of Interior-Point Methods for Nonlinear Programming Part 1

Margaret Wright, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, 10012, United States of America, mhw@cs.nyu.edu

The 1984 "interior-point revolution" in optimization could equally well be called an "interior-point renaissance" because of its interconnected combination of old and new ideas. The two speakers will address several themes, including: the pre-1984 rise and fall of interior-point methods; old ideas that have been revived and extended; and genuinely new ideas related to computational complexity, ties with linear algebra, and approaches for large-scale problems.

2 - Then and Now: The Renaissance of Interior-Point Methods for Nonlinear Programming Part 2

Philip Gill, Professor, University of California, San Diego, 9500 Gilman Drive, # 0112, La Jolla, CA, 92093-0112, United States of America, pgill@ucsd.edu

The 1984 "interior-point revolution" in optimization could equally well be called an "interior-point renaissance" because of its interconnected combination of old and new ideas. The two speakers will address several themes, including: the pre-1984 rise and fall of interior-point methods; old ideas that have been revived and extended; and genuinely new ideas related to computational complexity, ties with linear algebra, and approaches for large-scale problems.

3 - Interior Point Methods for Very Large Scale Optimization 25 Years Later

Jacek Gondzio, Prof, Edinburgh University, School of Mathematics, Edinburgh, EH9 2EA, United Kingdom, J.Gondzio@ed.ac.uk

This talk will focus on remaining challenges faced by interior point methods for very large scale optimization. In particular, the issues of iterative methods and a choice of suitable preconditioners to solve reduced Newton systems arising in optimization with interior point methods will be addressed.

■ MC61

H-Room 312, Third Floor

New Location Models with Capacity, Closest Assignment or Time-window Constraints

Sponsor: Location Analysis
Sponsored Session

Chair: Leyla Ozsen, Assistant Professor, San Francisco State University, 1600 Holloway Ave., Business Building, San Francisco, CA, 94132, United States of America, leyla_ozsen@mac.com

1 - Generalized Constraints for Closest Assignment in Location Modeling

Richard Church, Professor, Department of Geography, University of California Santa Barbara, Santa Barbara, United States of America, church@geog.ucsb.edu, Ting Lei

Special constraints are needed to enforce closest assignmnet allocation in many location problems including the budget constrained p-median problem and the weighted benefit covering problem. Over the past few decades four major types of constraint structures have been proposed to force closest assignment. This paper shows how each structure can be generalized to handle multi-level problems as well as presents an application of these constraints to a multi-level interdiction problem.

2 - Warehouse Capacity-Acquisition Location Models

Nayoung Cho, Department of Management Sciences, The University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242-1000, United States of America, chon@purdue.edu, Leyla Ozsen

We study a warehousing network design problem for a two-stage and single product supply chain with stochastic demand. Our objective is to determine the capacity and location of warehouses and the retailer-warehouse assignments that minimize the sum of the capacity, transportation, ordering, and inventory costs across the whole supply chain. For various types of capacity acquisition cost functions, we propose solution methodologies based on Lagrangian Relaxation.

3 - Optimizing Distribution with Time Windows and Service Modes for a Candy Supply Chain

Zeliha Akca, PhD Candidate, Lehigh University, Industrial & Systems Eng., 200 W. Packer Ave, Bethlehem, PA, 18015, United States of America, zelihaakca@lehigh.edu, Larry Snyder

We develop a MIP model to optimize the distribution network of the candy company Just Born. The model determines distribution centers and service mode (direct vs. LTL) for each demand and constructs shipment schedules and vehicle routes based on time windows. We extend the model with a set of new variables and valid inequalities. We improve the optimization process with an upper bound based on the LP relaxation. We empirically demonstrate the effectiveness of the model on real world instances.

■ MC62

H-Room 313, Third Floor

Capturing Human Behavior with System Dynamics Models

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch

1 - Managing R&D Pipeline Performance: Evidence From the Pharmaceutical Industry

Paulo Figueiredo, Boston University, paulof@bu.edu, Nitin Joglekar, Stephen Rosenthal

Key decisions in a R&D pipeline are: screen thresholds, complexity of projects, global and local resource allocation biases while adjusting capacity. We explore the impact of structural and behavioral aspects of these decisions through a simulation based analysis of a pharmaceutical dataset. Results establish concave relationships between value created at the end of pipeline and the resource allocation and complexity allocation biases, indicating a limit for front loading practices.

2 - In Search of the Bullwhip: The Credit Crisis

Jan Fransoo, Professor, Eindhoven University of Technology, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, J.C.Fransoo@tue.nl

After the collapse of Lehman brothers, substantial drops in demand were observed by many manufacturing companies. Empirical material supports our hypothesis this has been largely due to destocking, causing a severe global bullwhip. We deploy a straightforward system dynamics model and attempt to predict the recovery process. We predict the Summer/Fall 2009 recovery, but also a fallback in early 2010.

3 - Impact of Shortages on Single-supplier Multi-retailer Supply Chain

Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch, Santiago Arango

We investigate through a set of experiments the impact that individual and locally rational decisions of suppliers and retailers has on supply chain performance, in a single-supplier multi-retailer supply chain constrained by supply shortages.

■ MC63

H-Room 314, Third Floor

Health Care Logistics

Contributed Session

Chair: Raja Jayaraman, Post Doctoral Fellow, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu

1 - Physician Learning and the Healthcare Supply Chain

Cara Dienes, Iowa State University, 3038 Black Engr., Ames, IA, 50014, United States of America, cdienes@iastate.edu, John Jackman

Physician preference items are a key component of healthcare supply costs, due in part to the high rate of technological change that these supplies are subject to. This work models the relationship between the device manufacturer and the physician using game theory, in order to understand how the physician's learning and the manufacturer's time-pacing and product rollover decisions interact.

2 - Opportunities for Improvements in Healthcare Logistics Revealed

Brian Smith, Graduate Research Assistant, University of Arkansas, Department of Industrial Engineering, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bks07@uark.edu, Heather Nachtmann, Ed Pohl

Research has shown that the healthcare supply chain is an area with great potential for cost and quality improvements. In 2008, we surveyed over 1,350 healthcare supply chain professionals to investigate the state of the healthcare supply chain. The survey responses are analyzed to understand and report the impact of cost inefficiencies and identify opportunities for improving the quality of healthcare delivery. These results are presented here.

3 - Service Level, Ordering/Holding Cost and Capacity Tradeoffs for Pharmaceutical Inventories

Peter Kelle, Professor, Louisiana State University, 3195 Taylor Hall, ISDS Department, Baton Rouge, LA, 70803, United States of America, qmkell@lsu.edu, Helmut Schneider, Sonja Wiley-Patton, John Woosley

We provide simple, close to optimal rules for the safety stock and cycle stock allocation under space constraint for pharmacy inventories. We analyze the tradeoffs among the service level (emergency refill workload), ordering cost (refill workload), holding cost, and the available space (depending on the variety of drugs' formulary).

4 - Technology Requirements for Adoption of Healthcare Supply Chain Data Standards

Raja Jayaraman, Post Doctoral Fellow, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu, Ronald L. Rardin, Nebil Buyurgan, Anglelica Burbano

Proposed data standards offer unambiguous identification of goods and trading partners across the healthcare supply chain. The materials, inventory, IT and clinical systems require a variety of changes to implement data standards. In this presentation we shall highlight some of the unique technology support challenges and its realized benefits.

■ MC64

H-Room 202A, Second Floor

Panel Discussion: Advising Undergraduate Research

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Moderator: Susan E Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Blvd., Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

1 - Undergrad RAs at a Research University

Panelist: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

I will talk about my experiences supervising undergraduate research projects in Industrial and Operations Engineering at the University of Michigan.

2 - Advising Undergraduate Research

Panelist: Kevin Hutson, Associate Professor, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, kevin.hutson@furman.edu

Advising undergraduate research at liberal arts colleges can be difficult since, often, these students have to invest a large portion of their freshman and sophomore years taking general education requirements and have very little exposure to operations research. Here I discuss my experiences (both successful and disasterous) advising summer research in operations research with liberal arts mathematics students.

3 - Advising Summer Research Experiences at a Small College

Panelist: Mike Veatch, Gordon College, 255 Grapevine Rd, Wenham, MA, 01984, United States of America, mike.veatch@gordon.edu

4 - Undergraduate Senior Experiences in OR

Panelist: Allen Holder, Rose-Hulman Inst. of Tech., 5500 Wabash Ave., Terre Haute, IN, 47803, United States of America, holder@rose-hulman.edu

The capstone/senior experience is common in undergraduate curricula, and we will discuss the qualities that comprise a positive experience. In particular, we will highlight the favorable role OR plays across the undergraduate experience in math, science, and engineering.

■ MC75

C-Room 32A, Upper Level

Railroad Capacity Planning Session I

Sponsor: Railroad Applications
Sponsored Session

Chair: Clark Cheng, Sr. Manager Operations Research, Norfolk Southern Corp., 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, Clark.Cheng@nscorp.com

1 - LineMAX: Line Capacity Analyzer at Norfolk Southern
Vinay Mehendiratta, Operations Research Analyst, Norfolk Southern, 1200 Peachtree St, Atlanta, GA, 30309, United States of America, vinay.mehendiratta@nscorp.com, Pete Murgas

We describe the development and application of a Line Capacity Model at Norfolk Southern Railroad (NS) for use in evalution of capacity issues. The model uses meet pass optimizer to calculate the capacity of a line segment and takes train schedule of scheduled trains, method of operations, train types and priorities, and infrastructure into consideration.

2 - Capacity Planning and the Total Service Integration Process at CSX
Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com, Gabriel Farra, Chuck Martin

Managing capacity on the line of road and at terminals is a challenge on single track high density line segments. The process of improving capacity is defined and has various approaches to addressing the shortfalls, however linking these improvements with how access is gained to the line segments can make planning much more proactive and improvements more effective.

3 - Dispatching System Developments at BNSF Railway
Roger Baugher, Director, Interline and Special Projects, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States of America, roger.baugher@bnsf.com

BNSF Railway is developing new user interfaces to improve the planning of meets and passes. The systems will be described and demonstrated.

Monday, 4:30pm - 6:00pm

■ MD01

C-Room 21, Upper Level

Decision Analysis Society Awards

Sponsor: Decision Analysis
Sponsored Session

Chair: Jack Kloeber, Kromite LLC, 12 Penns Trail, Newtown, PA, 18940, United States of America, jkloeber@kromite.com

1 - Student Paper Award
Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu

The Student Paper Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the Decision Analysis Society of INFORMS. We will recognize the finalists, and the winning paper will be presented.

2 - DA Publication Award
Rakesh Sarin, UCLA, The Anderson School, Los Angeles, United States of America, rakesh.sarin@anderson.ucla.edu

3 - DA Practice Award
J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

The DAS Practice Award is given annually to the best application of decision analysis, as judged by a panel of decision analysis academics and practitioners. We will recognize the finalists and the winner.

4 - Frank P. Ramsey Medal
Robert Winkler, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States of America, rwinkler@duke.edu

The Frank P. Ramsey Medal is the highest award of the Decision Analysis Society, and it recognizes distinguished contributions to the field of decision analysis. The medal is named in honor of Frank Plumpton Ramsey, a Cambridge University mathematician who was one of the pioneers of decision theory in the 20th century.

■ MD02

C-Room 22, Upper Level

Decision Analysis I

Contributed Session

Chair: Gurcan Bicken, Dir. of Pricing and Product Opt., Autozone, 123 S Front St, Memphis, TN, United States of America, gurcan.bicken@gmail.com

1 - K-Distributions: A Galaxy of New Probability Distributions With Assessed-Fractile Parameters
Tom Keelin, Managing Partner, Keelin Reeds Partners, 800 Menlo Avenue, Suite 210, Menlo Park, CA, 94025, United States of America, tomk@keelinreeds.com, Brad Powley

This paper introduces a new class of probability distributions for flexibly and accurately representing uncertainty. K-distributions promise to revolutionize decision analysis (DA) by providing easy-to-use continuous distributions that exactly reflect assessed fractiles, have desirable smoothness properties, make 3-branch discrete approximations of continuous uncertainties unnecessary, are easy to simulate, and that overall make DA simpler, easier, faster, more accurate, and more fun.

2 - K-Distributions: Characterization and Exploration
Brad Powley, PhD student, Stanford University / Management Science & Engineering, Terman Engineering Center, 380 Panama Way, Stanford, CA, 94305, United States of America, bpowley@stanford.edu, Tom Keelin

K-Distributions are a new class of probability distributions that facilitate uncertainty representation and processing in decision analysis. K-Distributions with simple functional forms have the flexibility to represent a wide variety of distributional shapes despite limits on assessed fractile parameters. We derive these limits and demonstrate this flexibility.

3 - Streamlining the Global Manufacturing Throughput in T-MEX Trade Corridor- A Case for Distribution
Malini Natarajarathinam, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, malini@entc.tamu.edu, Bimal Nepal, Roberto Murrillo

Globalization and outsourcing is changing the manufacturing map of the globe. This paper presents preliminary results of a study on the opportunities and challenges for developing manufacturing industry along Texas- Mexico trade corridor. It focuses on a case for distribution industry which would like to sell to customers in Mexico. It presents a decision analysis model to help a distributor with its stocking location decisions. Scenarios for both new and established distributors are analyzed.

4 - Space Constrained Optimal Assortment for Products with Conditional Demand Characteristics
Gurcan Bicken, Dir. of Pricing and Product Opt., Autozone, 123 S Front St, Memphis, TN, United States of America, gurcan.bicken@gmail.com, Baofu Ma

Given a finite shelf space in stores for a category, we seek optimal stocking decisions for after market auto parts of different brand names for different model cars. The optimization problem involves the items' conditional sales estimations at the stores based on the stocking scenarios where only one or two of the products of the competing brand names are stocked. Special constraints are applied to the choice products of different brand names according to the competition scenarios.

5 - Business Analytics: Implications for Operations Research Professionals
Matthew Liberatore, John F. Connelly Chair in Management, Villanova University, 800 Lancaster Avenue, Villanova PA 19085, United States of America, matthew.liberatore@villanova.edu, Wenhong Luo

Business analytics and fact-based decision-making are playing increasingly prominent roles in many organizations. This paper discusses the key differences and the relationship between business analytics and traditional OR applications. We also highlight the implications of business analytics for OR professionals and how they can take advantage of this new analytical environment.

■ MD03

C-Room 23A, Upper Level

Analytic Hierarchy Process

Contributed Session

Chair: Myron Hatcher, Professor, Craig School Of Business, California State University, 5245 North Backer Av M/S PB7, Fresno, CA, 93740, United States of America, myronh1225@hotmail.com

1 - Deriving Ratio Scales a Comparison of Stevens and Saaty

William Wedley, Professor Emeritus, Simon Fraser University, Faculty of Business Administration, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, wedley@sfu.ca, Eng Choo

Stevens' magnitude estimation is popular in psychometrics for measuring ratios of qualitative attributes. Saaty's paired comparison process is popular in MCDM for measuring qualitative attributes. Both methods have similar ratio objectives, yet there is very little cross reference in the literature. This study compares Stevens' vector estimation approach to Saaty's matrix calculation approach. It describes the techniques, documents their strengths and weaknesses, and discusses issues.

2 - Analysis and Evaluation of Technological and Operational Alternatives for Heavy Oil Gathering System

Mario Castillo, Titular Professor, Universidad de los Andes, Carrera 1 Este No 19A - 40, Bogota, Colombia, mcastill@uniandes.edu.co, Jose Antonio Padilla, Fredy Nino, Jorge Bustamente, Luis Jose Novoa, Andres Zarate, Juan Carlos Gutierrez

The objective of this project is to develop a general methodology and models for the analysis and evaluation of transportation alternatives for heavy crude oil in two particular fields. Three models were developed, a hydraulic model, a financial model, and a qualitative model. In a first step, these models were applied to a generic unit of analysis, where simulated wells are distributed in a generic manner, and then the results were successfully used in the real fields.

3 - Data Collection Approach in Using Analytic Herarchy Process for Asset Evaluation

Myron Hatcher, Professor, Craig School Of Business, California State University, 5245 North Backer Av M/S PB7, Fresno, CA, 93740, United States of America, myronh1225@hotmail.com

The challenge of obtaining data for asset evaluation specifically for the ANALYTIC HERARCHY PROCESS (AHP) will be reviewed. Subjective data is collected from the decision maker. Objective data about properties are obtained from computerized records and interviews with owner/agent. The problems are correct reflection of the decision maker's values and accurate data about the property. The issues are discussed in reference to the multivariate decision method AHP.

■ MD04

C-Room 23B, Upper Level

Rich Preference Models in Advertising Auctions

Cluster: Auctions

Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, Vancouver, Canada, kevinlb@cs.ubc.ca

1 - Computational Analysis of Perfect-Information Position Auctions

David R.M. Thompson, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, daveth@cs.ubc.ca, Kevin Leyton-Brown

Position auctions were widely used by search engines to sell keyword advertising before being well understood theoretically. This paper augments current theoretical work, using computational equilibrium analysis. By computing Nash equilibria and calculating their expected revenue and social welfare, we can quantitatively answer questions that theoretical methods have not.

2 - Channel Abstraction for Optimized Expressive Advertising Auctions

Tuomas Sandholm, Professor, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sandholm@cs.cmu.edu, William Walsh, Craig Boutilier, David Parkes, Robert Shields, George Nemhauser

Expressiveness and optimization dramatically improve revenue and efficiency in advertising auctions, but direct formulations grow exponentially in the number of bids or attributes. Our approach automatically abstracts supply into channels, based on column and constraint generation. Experiments demonstrate the computational practicality and high solution quality. Theoretical results are also presented.

3 - Simulation-based Game Theoretic Analysis of Keyword Auctions with Low-dimensional Bidding Strategies

Yevgeniy Vorobeychik, University of Pennsylvania, 15 Montgomery Ave, Apt. 6A, Bala Cynwyd, PA, 19004, United States of America, eug.vorobey@gmail.com

We perform a simulation-based analysis of keyword auctions modeled as one-shot Bayesian games. Our results suggest that sincere bidding in GSP auctions is a strikingly poor strategy. Our conclusions from profit analysis agree with Lahaie and Pennock [2007] when values and quality scores are strongly positively correlated. We diverge, however, in showing that auctions that put little weight on quality scores almost universally dominate the pure rank-by-revenue scheme.

■ MD05

C-Room 23C, Upper Level

Panel Discussion: Quality, Statistics and Reliability Issues in Industries

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Moderator: Satish Bukkapatnam, Professsor, Oklahoma State University, School of Industrial Engineering and Man, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu

Russell Barton, Professor, Smeal College of Business, Penn State, 406 Business Building, University Park, PA, 16802, United States of America, rrb2@psu.edu

1 - Industry Application of Statistics & Reliability

Panelist: Jayant Kalagnanam, Senior Manager, IBM T.J. Watson Research Center, Yorktown Hts, NY, 10598, United States of America, jayant@us.ibm.com

I will discuss applications in the Semiconductor Industry and the Oil Industry related to monitoring and reliability and discuss current practices. A major issue with monitoring is model drift. I will discuss some experience with monitoring off-shore oil drilling. Maintenance planning requires reliability analysis coupled with optimization to maximize availability. I will present some approaches that we have developed for simulation based optimization for maintaining oil platforms.

2 - Remote Condition Monitoring and Proactive Service of Medical Imaging Equipment

Panelists: Yibin Zheng, Cris Sievenpiper, Rick Frowein, Kamal Mannar

GE Healthcare is developing technologies to remotely monitor operating parameters of major medical imaging equipment, and in the course, develop correlation of machine data with service patterns. The technologies enable us to automatically and proactively schedule services in many cases, thus eliminate or reduce customer downtime while also improve our service operation's productivity. The presentation describes a general framework and several specific data modeling and data mining approaches.

■ MD06

C-Room 24A, Upper Level

Recent Advances in Computer Experiments I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Peter Qian, Assistant Professor, University of Wisconsin-Madison, 1300 University Ave, Department of Statistics, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Building Surrogates with Overcomplete Bases in a Computer Experiment for Bistable Laser Diodes

C F Jeff Wu, Coca Cola Chair in Engineering Statistics, Georgia Institute of Technology, Atlanta, United States of America, jeffwu@isye.gatech.edu, Raybin Chen, Wei C Wang

Motivated by a problem in bistable laser diodes, we construct surrogates iteratively for the complicated surface by using an overcomplete basis set. Computational results show that the proposed algorithms can solve the target problem by (i) capturing the trend of the surface quickly, (ii) guiding the search to regions containing the solutions, and (iii) identifying all solutions efficiently. Performances of the proposed algorithms and two Gaussian process-based algorithms are presented.

2 - Spatial Analysis of Regional Climate Model Ensembles
Stephan Sain, NCAR, P.O. Box 3000, Boulder, CO, 80307, United States of America, ssain@ucar.edu

The North American Regional Climate Change Assessment Program (NARCCAP) seeks to examine uncertainty in regional climate models and projections of climate change through the use of a multi-model ensemble. We are developing statistical methodology to analyze the output in this ensemble based on a Bayesian hierarchical framework incorporating a multivariate spatial model. Case studies will be presented based from NARCCAP focusing on changing precipitation, temperature, and heat waves.

3 - Using Multiple Computer Models/Multiple Data Sources Simultaneously to Infer Calibration Parameters
Brian Williams, Los Alamos National Laboratory, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States of America, brianw@lanl.gov, Max Morris, Thomas Santner

Many computer models are often available to predict the same outcomes. Different physical representations lead to model-specific calibration parameters. In addition, many applications have access to multiple data sources for calibrating uncertain model parameters. This talk describes methodology that uses the outputs from all available computer models and data sources for parameter calibration and ensemble prediction of code output.

4 - Particle Learning Gaussian Processes for Optimization and On-line Classification
Robert Gramacy, Dr, University of Cambridge, Statistical Laboratory, Wilberforce Dr., Cambridge, CB3 0WB, United Kingdom, bobby@statslab.cam.ac.uk

We devise a sequential Monte Carlo method, via particle learning, for sequential updating of the posterior distribution of Gaussian process models for regression, and for classification via latent variables. We exploit the on-line nature of inference to build thrifty sequentially design for optimization via expected improvement and for on-line classification via the predicted entropy.

■ MD07

C-Room 24B, Upper Level

Decision Theoretic Approaches for Quality and Reliability Assessment

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Martin Wortman, Professor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

Co-Chair: Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu

1 - High-stakes Wagering on Reliability
Martin Wortman, Professor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

Reliability modeling often supports "high-stakes wagers" associated with the deployment and operation of technology. In this presentation we will examine reliability driven engineering decisions in the context of a gambling paradigm. In particular, we will explore the ramifications of limited prior information characterizing operational performance or reliability testing on high-consequence engineering decisions.

2 - Reliability Modeling and Technology Assessment for Capital Equipment Acquisition Decisions
Samuel Merriweather, Texas A&M University, Industrial & System Engineering, College Station, TX, 77843, s_merriweather@neo.tamu.edu

Within this presentation we will discuss a risk-based approach to capital equipment budgeting and acquisition supported by reliability/availability life cycle models. We are particularly concerned with technology assessment decisions where capital equipment budgets carry profound financial risk (e.g., small health care facilities) and candidate acquisitions are new technologies having little operational history.

3 - Recurrence-based Local Gaussian Process Method for Nonlinear Non-Stationary System Prediction
Changqing Cheng, Oklahoma State University, Stillwater, OK, 74078, United States of America, changqing.cheng@okstate.edu, Hui Yang, Satish Bukkapatnam

Local Gaussian process (LGP) used for nonlinear process predictions has been extended based considerations of local recurrence properties under highly nonstationary conditions. The method outperforms the global Gaussian process (GGP) in terms of the computational time and prediction accuracy.

4 - Sequential Bayesian Decision Making for End-Point Detection Chemical Mechanical Planarization (CMP)
Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu, Satish Bukkapatnam, Ranga Komanduri, Omer Beyca

In Chemical Mechanical Planarization (CMP) process, accurate and timely decisions for process monitoring and control, such as endpoint detection (EPD), are extremely critical to enable the process to effectively respond to demand variations and disruptions. In this paper, we apply sequential Bayesian analysis and decision theory to find a quantitative relationship that connects the measured sensor signal features with the material removal for endpoint detection of the CMP process.

■ MD08

C-Room 24C, Upper Level

Joint Session DM/HAS: Data Mining and Knowledge Discovery in Healthcare - II

Sponsor: Data Mining & Health Applications
Sponsored Session

Chair: Durai Sundaramoorthi, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu

1 - Development of a Dynamic Treatment Regime for Pain Management
Ching-feng Lin, University of Texas at Arlington, Industrial & Manufacturing Systems Engr., Arlington, TX, United States of America, ching-feng.lin@mavs.uta.edu, Victoria Chen, Robert Gatchel

Pain management is an international health issue. The Eugene McDermott Center for Pain Management at the University of Texas Southwestern Medical Center at Dallas has been studying a two-stage interdisciplinary pain management program that considers a wide variety of treatments. We apply an approximate dynamic programming approach to construct an adaptive treatment strategy for this two-stage program. State transition models were constructed empirically based on data from the two-stage program.

2 - Optimization and Data Mining in Medicine
Vera Tomaino, PhD Student, University Magna Graecia of Catanzaro, 3425 S.W. Second Avenue, Apt 157, Gainesville, FL, 32607, United States of America, vera.tomaino@unicz.it

Mathematical theory of optimization has found many applications in the area of medicine over the last few decades. Several data analysis and decision making problems in medicine can be formulated using optimization and data mining techniques. The significance of the mathematical models is greatly realized in the recent years owing to the growing technological capabilities and the large amounts of data available.

3 - Predictive Analysis (Data Mining) Implementation: Predicting the Risk of an Individual Contracting NP
Louis Duclos-Gosselin, Applied Mathematics (Predictive Analysis, Data Mining) Consultant at Sinapse, Sinapse, 1170 Boul. Lebourgneuf, bureau 320, Quebec, QC, G2K2E3, Canada, louis.gosselin@hotmail.com, Rene Yves Darmon, Benny Rigaux-Bricmont

Starting from earlier health management sciences studies, managers have always tried to find better techniques to effectively manage health operations in order to reduce the costs while increasing patients' wellbeing. This paper shows how managers can use predictive analysis to address such problems. A new predictive analysis technique for solving problems related to the risk of an individual contracting nosocomial pneaumonia (NP) is presented. The technique has been tested on health data.

■ MD09

C-Room 25A, Upper Level

Asymptotic Analysis of Queueing Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Ramandeep Randhawa, University of Sourthern California, Los Angeles, CA, United States of America, Ramandeep.Randhawa@mccombs.utexas.edu

1 - Joint Scheduling of Jobs and PM's in Multiclass Systems
John Hasenbein, Associate Professor, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, jhas@mail.utexas.edu, Yiwei Cai, Erhan Kutanoglu

In semiconductor wafer fab operations there has been increasing interest in performing "predictive maintenance" in conjunction with job scheduling. In this work, we develop a stylized Markov decision model to represent the joint scheduling process. We give characterizations of the optimal policy in both the single and multiclass cases and calculate optimal policies. In some cases, the optimal policies suggest counterintuitive decisions.

2 - Optimal Buffer Size and Dynamic Rate Control for a Queueing Network with Reneging in Heavy Traffic
Arka Ghosh, Iowa State University, 3216 Snedecor Hall, Department of Statistics, Iowa State University, Ames, IA, 50011-1210, United States of America, apghosh@iastate.edu, Ananda Weerasinghe

We address a control problem associated with a single server Markovian queue with customer abandonment with an infinite horizon discounted cost under heavy traffic. The controls are: buffer size for the queue and a state-dependent service rate. By solving the limiting diffusion control problem explicitly, we propose a suitable control for queueing network and prove its asymptotic optimality. This optimal solution also identifies the parameter regimes where the infinite buffer size is optimal.

3 - Accuracy of Fluid Models for Capacity Planning in Queueing Systems
Ramandeep Randhawa, University of Sourthern California, Los Angeles, CA, United States of America, Ramandeep.Randhawa@mccombs.utexas.edu, Achal Bassamboo

We study the optimal capacity sizing problem for an M/M/N+G system. We use fluid models to characterize near-optimal prescriptions. These prescriptions depend intricately on the entire abandonment distribution and can lead to an operating regime with traffic intensity greater than 1. We demonstrate that in this case, the prescription is optimal up to O(1). That is, as the customer arrival rate increases, the optimality gap does not grow.

■ MD10

C-Room 25B, Upper Level

Approximate Dynamic Programming and Large-Scale Stochastic Optimization

Sponsor: Applied Probability
Sponsored Session

Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

Co-Chair: Vivek Farias, Assistant Professor, MIT Sloan School, E53-317, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, vivekf@mit.edu

1 - Approximate Dynamic Programming via a Smoothed Linear Program
Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Vivek Farias, Vijay Desai

We present a novel algorithm for approximate dynamic programming (ADP) which we call smoothed approximate linear programming (SALP). SALP is a relaxation of the standard LP approach to ADP that offers several advantages: We demonstrate superior theoretical bounds the resulting approximation quality. Experiments with SALP on a challenging problem (the game of Tetris) show that it outperforms a variety of ADP algorithms (LP, TD-learning and policy gradient methods) by a significant margin.

2 - Markov Decision Processes with CVAR Constraints
Vivek Borkar, Professor, Tata Institute of Fundamental Research, Homi Bhabha Road, Mumbai, 400005, India, borkar@tifr.res.in, Rahul Jain

We consider the problem of controlling a Markov decision process where an associated conditional value-at-risk (CVAR) is required to be bounded by a prescribed constant. A dynamic programming based formulation of the problem suggests a recursive scheme for computing the optimal solution.

3 - Reservoir Management Based on Approximate Dynamic Programming
Zheng Wen, 123 Blackwelder Ct. Apt. 109, Stanford, 94305-7519, United States of America, zhengwen@stanford.edu, Khalid Aziz, Louis Durlofsky, Benjamin Van Roy

Petroleum reservoir management is in general a large-scale, nonlinear dynamic optimization problem. In this project, we propose computational methods to solve this problem based on Approximate Dynamic Programming. Specifically, we generate features of the approximate value function based on Proper Orthogonal Decomposition and compute the weights of features based on TD-Learning and Approximate LP. Some simulation results based on this algorithm are also demonstrated.

4 - Managing Customer Goodwill with Approximate Dynamic Programming
Dan Adelman, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, United States of America, dan.adelman@chicagobooth.edu, Adam Mersereau

We develop an approximate dynamic programming approach to the problem faced by a supplier deciding how to dynamically allocate limited capacity among a portfolio of customers who remember the fill rates provided to them in the past when making ordering decisions.

■ MD11

C-Room 25C, Upper Level

Operations Research and Decision Sciences Applications for Terrorism and Border Security

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Henry H Willis, Policy Researcher, RAND Corporation, 4570 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, hwillis@rand.org

1 - Community Response to Crisis: Modeling the Social Amplification of Risk
William Burns, Research Scientist, Decision Research, 511 Hillock Place, Encinitas, CA, 92024, United States of America, bburns@csusm.edu

Paper investigates how public response to a disaster translates into potentially large economic impacts. A taxonomy is proposed that looks at risk perception not only in terms of an event's characteristics but also in terms of context, seeks to capture risk-related behavior over time and in response to other critical factors and suggests that we not only describe risk response but do so in a way that informs risk management decisions. Survey data and output from the systems model presented.

2 - Bandits and Border Security
Joel Predd, Researcher, RAND Corporation, 4570 Fifth Avenue, Pittsburgh, PA, 15208, United States of America, jpredd@rand.org, Henry H Willis

DHS has the responsibility to protect and control U.S. borders against terrorist threats, criminal endeavors, illegal immigration and contraband. Unfortunately, resource constraints make it infeasible to "see and be" everywhere at once, and necessitate allocating limited border assets to the places where and at the times when they may be most effective. The talk describes research to model tactical, resource-constrained border allocation decisions as multi-armed bandit problems.

3 - Value Focused Thinking for Evaluating Alternative Counter-terrorism Policies
Richard John, Associate Professor, University of Southern California, CREATE & Dept of Psychology MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu, Heather Rosoff

Decisions related to counter-terrorism policy typically involve multiple and conflicting objectives. Both public and private decision makers must devise policies to counter threats from terrorist organizations that reflect concerns such as health and safety, rights to privacy, economic growth, and direct costs. We demonstrate the use of value focused thinking and multi-attribute utility modeling to aid in the formation and evaluation of competing policy options.

4 - A Decision Framework for Assessing Border Security Risks and Mitigation
Larry Head, Associate Professor, University of Arizona, University of Arizona, Tucson, AZ, 85721, United States of America, larry@sie.arizona.edu, Michael Leeming, Jian Liu, Ferenc Szidarovszky, Cheng Zhu

Risk at national borders is a complex phenomenon that includes a variety of events and activities that extend from concerns for criminal networks, illegal immigration, environmental, and health risks. Border risks activities are

composed of sequences of events that involve a variety of actors, their communications, facilities, and interaction with security systems. This research focuses on the structure of a decision framework for assessing risks through activity identification and prediction.

■ MD12

C-Room 26A, Upper Level

Hidden Linearity, Hidden Convexity, and Hidden Separability in General Nonlinear Programming — Uncovered, Reformulated, and then Transformed for Both Qualitative and Quantitative Exploitation I

Sponsor: Computing Society
Sponsored Session

Chair: Elmor Peterson, Systems Science Consulting, 3717 Williamsborough Court, Raleigh, United States of America, elpeterson@alumni.cmu.edu

1 - An Introductory Tutorial
Elmor Peterson, Systems Science Consulting, United States of America, elmor.peterson@gmail.com

Novel explanations (using only elementary calculus and linear algebra) introduce the signature qualitative and quantitative natures that characterize both 'geometric programming' (the original prototype methodology for nonlinear-algebraic optimization) and its various generalizations (including general nonlinear optimization/equilibration) — each of which has evolved over the past 49 years, beginning with the seminal work of Zener and Duffin on unconstrained "signomial" optimization.

■ MD13

C-Room 26B, Upper Level

COIN-OR Software Solutions for Real Applications

Sponsor: Computing Society
Sponsored Session

Chair: Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

1 - Optimization and Control of Clean Technologies with COIN-OR
Timothy Middelkoop, Assistant Engineer, University of Florida, 303 Weil Hall, Gainesville, United States of America, t.middelkoop@ufl.edu, Elif Akcali, Cristiàn Càrdenas

In this paper we show how COIN-OR provides the software solutions required to solve real world energy optimization problems. Energy and climate pressures in today's society have created a demand to use energy more efficiently and intelligently. In order to solve this problem there is a need to integrate advanced energy optimization with modern control technologies. The paper details the use and integration of the COIN-OR project tools in such an energy control framework.

2 - Transportation System Design Using COIN-OR
Saravanan Kuppusamy, PhD Student, Department of Quantitative Analysis and Operations Management,College of Business,University of Cincinnati, 2925 Campus Green Drive, P.O. Box 210130, Cincinnati, OH, 45221-0130, United States of America, kuppussn@email.uc.edu, Kipp Martin, Michael Magazine

The Bearcat Transportation System of the University of Cincinnati is modeled and solved as a multiple vehicle routing problem. The Student population and travel time data coupled with client driven constraints are used to design the transportation system. The COIN-OR solver CBC is used in a GAMS environment to solve the problem. Results indicate the solutions are effective and implementable.

3 - Scheduling Doctors to Clinical and Surgical Time Slots: A Column Generation Approach
Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu, Cary Wise, Craig Froehle, Michael Magazine

We consider the problem of scheduling doctors to clinical and surgical time slots over a five-week horizon. This leads to an integer program with millions of variables. We discuss the solution of this problem using column generation with COIN-OR branch cut and price (BCP).

■ MD14

C-Room 27A, Upper Level

Software for OR/MS IV

Sponsor: Computing Society
Sponsored Session

Chair: Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

1 - New Gurobi Solver Version 2.0
Robert Bixby, Gurobi Optimization Inc., 3733-1 Westheimer Road, Houston, TX, 77027, United States of America, bixby@gurobi.com

Some of the new features of Gurobi Version 2.0 will be discussed.

2 - New Stochastic Programming Enhancements for the MPL Modeling Language
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

Formulating stochastic models in a modeling language and deploying it to end-users has long been a challenge in practice. In this presentation we will review how both scenario-based and independent variables stochastic models can be effectively formulated in a modeling language, such as MPL. Several formulations of SP models will be demonstrated.

3 - Experimenting with Near-Optimal Integer Programming Formulations for Discrete Optimization Problems
Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

When a mixed-integer program can't be solved to optimality, sometimes much better results can be achieved by "cheating" a bit on its formulation: modifying the search space in ways not guaranteed to preserve the solution's optimality but highly unlikely to make a difference given the model and data of interest. A series of case studies illustrate that although a few general principles can offer guidance, much trial and error is involved, for which purpose a flexible modeling language is ideal.

4 - Handling Second Order Stochastic Dominance through Cutting Plane Representations of CVaR
Gautam Mitra, CARISMA, Brunel University, West London, United Kingdom, gautam.mitra@brunel.ac.uk, Csaba Fabian, Diana Roman, Viktar Zviarovich

Second order stochastic dominance (SSD) is used as a choice criterion in portfolio models due to its relation to risk-averse economic behaviour; the computational difficulty of solving SSD-based models is also well known. An SSD model is formulated as a multi-objective CVaR minimization problem which is then reformulated using a cutting plane representation of CVaR . This approach dramatically increases the execution speed and makes the model solvable even for very large number of scenarios.

■ MD15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Responsive Learning Technologies, Inc. - Online Games to Teach Operations and Supply Chain Management
Sam Wood, President, Responsive Learning Technologies, Inc., 4546 El Camino Real, Suite 243, Los Altos, CA, 94022, United States of America, wood@responsive.net

Participate in a demonstration of online games that are used in operations management courses and supply chain management courses in hundreds of undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

2 - LINKS-simulations.com - Best-Practice Teaching With a Sophisticated Supply Chain Management Simulation

Randall G. Chapman, LINKS-simulations.com, 320 Forest Haven Drive, Winter Garden, FL, 34787, United States of America, chapman@chapmanrg.com

Teaching with a sophisticated supply chain management simulation is a daunting instructional endeavor, especially with a full parsing of the adjective 'sophisticated.' As used here, 'sophisticated' includes the implicit descriptors 'large-scale,' 'competitive,' 'web-based' and 'team-based.' Drawing on simulation design experience, extensive personal teaching experience in traditional classroom-based and distance-learning modes, and 'train-the-trainer' coaching experience with 100+ instructors and their 25,000+ students with the LINKS simulations over the last ten years, the LINKS author provides and summarizes best-practice insights into the design and execution of successful simulation-based operations management and supply chain management courses. A guided-tour/demo of the LINKS website and associated user resources is provided.

■ MD16

C-Room 28A, Upper Level

Cognitive Neuroscience in Management Sciences

Sponsor: Information Systems
Sponsored Session

Chair: Angelika Dimoka, Assistant Professor - Director, Center for Neural Decision Making, Temple University, 510 Alter Hall, 1801 Liacouras Walk, Philadelphia, PA, 19122, United States of America, angelika@temple.edu

1 - Effective Health Marketing: Understanding the Underlying "Brain" Mechanisms of Self-Positivity Bias

Yanliu Huang, Assistant Professor of Marketing, Chinese University of Hong Kong, Shatin, NT, Hong Kong, China, yanliuh@wharton.upenn.edu, Angelika Dimoka

In three studies, the current research explores the brain mechanisms of self positivity bias ‚Ä' a robust finding that consumers' self-perceptions are in general self-enhancing and they tend to estimate the likelihood of something negative happening as lower for themselves than for others. Understanding the nature of self-positivity bias and coming up with corresponding marketing strategies to overcome these biases have important implications in the field of health marketing.

2 - To Trust or Not; New Insights From Functional Neuroimaging Studies

Angelika Dimoka, Assistant Professor - Director, Center for Neural Decision Making, Temple University, 510 Alter Hall, 1801 Liacouras Walk, Philadelphia, PA, 19122, United States of America, angelika@temple.edu

This study employs functional neuroimaging (fMRI) tools to complement psychometric measures of trust and distrust by observing the location, timing, and level of brain activity that underlies trust and distrust and their underlying dimensions. The neural correlates of trust and distrust are identified when subjects interact with four experimentally manipulated seller profiles that differ on trust and distrust (high and low).

3 - The Dark Side of Product Attachment: Reactivity of Addicted Users to Ad Cues

Dante Pirouz, Doctoral Candidate, University of California, Irvine, P.O. Box 10653, Newport Beach, CA, 92617, United States of America, dpirouz04@exchange.uci.edu

Advertising is a ubiquitous and pervasive environmental cue. On average, the typical consumer is exposed to three thousand ads per day. For the most part, consumers are able to filter which ads they attend to. For addicted consumers, however, environmental cues may elicit a unique type of response affecting decision making and risk behavior. Based on cue reactivity theory, this research investigates the effect of advertising on addicted users using fMRI.

■ MD17

C-Room 28B, Upper Level

Matching Operations and Marketing in Internet Retailing

Sponsor: e-Business
Sponsored Session

Chair: Ken Boyer, Professor, Ohio State University, Fisher College of Business, Columbus, OH, United States of America, boyer_9@fisher.osu.edu

1 - Is Tom Cruise Threatened? Empirical Examination the Long Tail of Electronic Commerce

Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Tom Tan

First popular press and then academic literature suggested that new economics of product distribution on the Internet are such that, over time, consumers will increasingly shift towards purchasing niche products and away from hit products. In this study we use a unique data set from an on-line movie rental company to study the dynamics of movie consumption on the Internet over time in an attempt to shed a new light on the causes and consequences of the Long Tail effect.

2 - Service Quality and Customer Loyalty for Pure-Play Internet Retailers

M. Johnny Rungtusanatham, Carlson School of Management, University of Minnesota, Minneapolis, MN, 55455, United States of America, rung0002@umn.edu

The relationship between service quality and customer loyalty is presumed to exist, be positive, and be linear. Anecdotal and empirical evidence tends to support this presumption. This research challenges the presumption of linearity in the context of pure-play internet retailing. We hypothesize and find support that the relationship is actually piece-wise linear, with a zone of indifference.

3 - Examining the Marketing Benefit of Real Options in an Internet Retailing Context

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

This paper empirically examines the impact of real options used to market service operations within an online retailing context. We estimate a regression function based on several real option factors, and discuss its implications.

4 - Using Customer Ratings to Predict Future Purchases

Ken Boyer, Professor, Ohio State University, Fisher College of Business, Columbus, OH, United States of America, boyer_9@fisher.osu.edu, Christian Randall

We employ a database of 15,000 customer ratings of shoes and the shoe buying experience to predict followup purchases in a longitudinal manner. The customer ratings are written comments which have been re-coded to assess operational aspects of the customer experience, including fit, quality, delivery and service. This data is matched with a separate database of purchases by those customers over the 6 following month timespan. All data furnished by a major online retailer of shoes.

■ MD18

C-Room 28C, Upper Level

Combinatorial Optimization Algorithms

Sponsor: Computing Society
Sponsored Session

Chair: Dorit Hochbaum, Professor, UC Berkeley, Dept of IEOR, Etcheverry Hall, Berkeley, CA, 94720, United States of America, hochbaum@ieor.berkeley.edu

1 - Polynomial Time Algorithms for Clustering and Image Segmentation Problems

Dorit Hochbaum, Professor, UC Berkeley, Dept of IEOR, Etcheverry Hall, Berkeley, CA, 94720, United States of America, hochbaum@ieor.berkeley.edu

We consider here clustering problems, which typical entail two or more objectives, and are often employed in the context of image segmentation. We show here that two problem, called in the literature "normalized cut" and another called "ratio cutswhich were both thought to be hard, are in fact solvable in polynomial time, and with very efficient cut-based algorithms. We also demonstrate efficient approaches to other clustering problems used in image segmentation.

2 - Fast Approximate Subset Sums

James Orlin, Professor, MIT, E53-363, Cambridge, Ma, 02139, United States of America, jorlin@MIT.EDU

Let S = {w_1, ,Ä¶, w_n} be a set of weights and let b be an integer. Given relative error q, we give a simple algorithm (an FPTAS) that produces a subset of S whose sum is in [b(1-q), b], or else the sum is the largest possible sum that is less than b. The running time is O((n + (1/q))^2)(log 1/q)). We also describe an even faster algorithm for approximate subset sum that relies on Fast Fourier Transforms (FFT), improving upon the previous best running time by nearly a factor of sqrt(1/q).

3 - A New Approximation Algorithm for the Asymmetric Traveling Salesman Problem

Amin Saberi, Professor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

Despite intensive effort, the O(\log n) approximation ratio established by Frieze et al. for the asymmetric traveling salesman problem has not been improved. In this talk, I will discuss a new approach that is based on choosing a "thin" spanning tree from the solution of the linear relaxation of this problem.

■ MD19

C-Room 28D, Upper Level

Urban Freight Transportation and Service Operations

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Felipe Sandoval, University of Washington, 135 More Hall, Seattle, WA, United States of America, felipe7@u.washington.edu

1 - Retailer Backhauling as a Policy to Cope with Urban Access Restriction Rules

Rene De Koster, Professor, Rotterdam School of Management, Erasmus University, T10-38,Burgemeester Oudlaan 50, Rotterdam, Netherlands, rkoster@rsm.nl, Hans Quak

Urban time-window regulations lead to low vehicle utilizations in retail distribution. We study possibilities for retailers to combine deliveries to the stores with backhauling, to improve vehicle utilization. We examine four retail cases under different time-window scenarios, and optimize vehicles routes. Backhauling under time-window restrictions appears to lead to much higher utilizations, with only a little increase in total travel distance.

2 - Matching Line Haul Truck Capacity to Customer Demand Using Dynamic Transfer Points

Agha Iqbal Ali, Chair, Finance and Operations Management, Isenberg School of Management, University of Masachusetts, 121 Presidents Drive, Amherst, MA, 01003, United States of America, aiali@som.umass.edu, Milad Ebtehaj

We study logistics scenarios in which the first echelon is a line haul of product to a dynamically determined transfer point from which second-echelon-distribution to demand points can be either direct, split, or joint. Three determinants that affect problem complexity are distribution configuration, demand patterns, and truck capacity. We report the results of a computational study that reveals the impact of these determinants on overall system wide capacity utilization and mileage.

3 - Optimal Workforce Deployment and Shift Scheduling for Snow and Ice Removal

Elif Tokar-Erdemir, University of Minnesota, 111 Church St., Minneapolis, MN, 55455, eerdemir@me.umn.edu, Diwakar Gupta

Because the timing, severity and duration of snowstorms are random, workforce deployment policies have a significant impact on state agencies' budgets. We use data from Saint Louis County in Minnesota to formulate the problem of deciding when to call/hold-back crew, which road segments to assign to each operator, and knitting each operator's assignment into passes that can be plowed/sanded with a single payload. We also study the impact of different types of uncertainty on deployment strategies.

■ MD20

C-Room 28E, Upper Level

Vehicle Routing and Variants

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Faramroze Engineer, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, fenginee@isye.gatech.edu

1 - ELOCONS: Efficient Low Cost Route Construction Heuristic for the VRPTW in SME's Field

Alejandro Garcia del Valle, Professor, University of A Coruna, Polytechnic School, Campus de Esteiro, Ferrol, NA, 15403, Spain, agvalle@udc.es, Adolfo Lamas Rodriguez, Javier Faulin, Arturo Nieto, Diego Crespo Pereira, David del Rio Vilas

ELOCONS is a route construction heuristic for the VRPTW. In the field of the small and medium enterprises (SME's), efficient solutions with low cost implementation and resource assignments are required. ELOCONS is based on logical decisions, obtaining very good experimental results on Solomon's 100 customers instances, showing that ELOCONS is highly efficient and robust, producing very good solutions in short time under a computational realistic environment.

2 - An Advanced Integer Programming Based Hybrid Heuristic for Generalized VRP-like Problems

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Placid Ferreira, Anupam Seth

Production planning for PCB assembly has defied standard OR approaches due to the size and complexity of the problems. We examine popular collect-and-place machines and model the problem as a generalized vehicle routing problem. We present a hybrid heuristic consisting of an initial constructive phase with a worst-case guarantee and an improvement phase based on integer-linear programming. Theoretical and computational results are presented to demonstrate the effectiveness of the technique.

3 - Extension of the Sweep Algorithm for Vehicle Routing Problems

Byung-In Kim, Associate Professor, Industrial & Management Engineering, POSTECH (Pohang University of Science & Technology), San 31, Hyoja-Dong, Pohang, Kyungbuk, Korea, Republic of, bkim@postech.ac.kr, Yeowoon Jun, Byungsoo Na

The sweep algorithm has been widely used for the vehicle routing problem and its variants since it was published in 1974. It clusters a group of customer stops into a route according to the polar angle for the stops with the depot. In this talk, we point out a limitation of the sweep algorithm and propose some extensions of the algorithm. The effectiveness of the extensions will be demonstrated with the computational results on the benchmark problems of vehicle routing problem.

4 - A Branch-price-and-cut Algorithm for a Maritime Inventory Routing Problem

Faramroze Engineer, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, fenginee@isye.gatech.edu, George Nemhauser, Jin-Hwa Song, Kevin Furman, Martin Savelsbergh

Our time indexed model does away with assumptions regarding constant capacities, production, and demand rates. We outline a new DP algorithm for the resulting mixed integer pricing problem. We also add variants of capacity cuts known for vehicle routing, and cuts that specifically target fractional solutions brought about by vessels competing for capacity and inventory. We can solve practically sized problems to optimality and prove reasonable bounds for larger problems.

■ MD21

C-Room 30B, Upper Level

Methods and Models for Road Pricing I

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu

Co-Chair: Siriphong Lawphonganich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611-6595, United States of America, lawphong@ise.ufl.edu

1 - Consistent Anticipatory Congestion Pricing: An Iterative Algorithm for Online Application

Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Jing Dong

This study presents a consistent anticipatory pricing problem that regulates dynamic congestion prices based on forecast traffic, e.g. for value pricing applications. To achieve consistency between predicted and experienced traffic conditions, we present a procedure that iterates between toll-setting (using predicted traffic conditions) and performance-evaluation (considering user response to tolls). Simulation results illustrate the effectiveness of this dynamic pricing algorithm.

2 - Congestion Option

Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Mike Mingcheng Wei, Yafeng Yin, Terry Friesz

We introduce the idea of a congestion call option to value commuting along a given path for a given departure time selected by road commuters who are modeled as non-cooperative agents competing for limited roadway capacity. We show that congestion options have the potential to lower the total society costs of congestion.

3 - Pareto-improving Dynamic Congestion Pricing with Heterogenous Commuters

Marco Nie, Assistant Professor, Northwestern University, Evanston, United States of America, y-nie@northwestern.edu, Yang Liu

This paper examines dynamic congestion pricing in a simple road network with parallel routes using bottleneck model. User heterogeneity is incorporated by considering different value of time and schedule delay penalties across the population. A Pareto-improving toll scheme is proposed, which aims to improve the social welfare while ensuring that no one is worse off in favor of others' gain.

4 - Congestion Pricing in Stochastic Networks with Users' Perception

Yingyan Lou, Assistant Professor, Department of Civil, Construction, and Environmental Engineering, The University of Alabama, Bevill Hall, The University of Alabama, Tuscaloosa, AL, 35487, United States of America, ylou@eng.ua.edu, Lihui Zhang, Yafeng Yin, Siriphong Lawphonganich

This paper applies the cumulative prospect theory to model users' spontaneous response to pricing signals in an uncertain traffic environment and then examines its impact on the efficiency of congestion pricing. Considering users' subjective perception of travel time distributions and value of travel choices, an optimization model is formulated to design pricing strategies for stochastic traffic networks.

■ MD22

C-Room 30C, Upper Level

Panel Discussion: The Academic Job Search

Cluster: Job Placement Service
Invited Session

Chair: Talisa Murray, Systems Analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu

1 - Academic Job Search

Moderator: Talisa Murray, Systems Analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu, Panelists: Feryal Erhun, Mark Ferguson, Ted Ralphs

The panel will lead an informal discussion concerning the academic interview process, the appropriate steps to take during the job search, and the challenges that may be faced along the way. Time will be provided for questions and answers.

■ MD23

C-Room 30D, Upper Level

DIME/PMESII Pt 5

Sponsor: Military Applications Society
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Wicked Problems and Comprehensive Thinking in Irregular Warfare

Mark Clemente, Senior Effects Based Analyst, The Boeing Company, 1215 S. Clark St, Ste 346 MC 793C-G029, Arlington, VA, 22202-4398, United States of America, Mark.N.Clemente@boeing.com, Ed Smith

Irregular Warfare requires close coordination between disparate actors that do not normally work together - military diplomatic, political, social, and economic and is fundamentally about wicked problems with no definitive solution. This paper combines James Grier Miller's Living Systems theory with complexity and decision making theory to offer a framework for understanding how to cope with wicked problems and for identifying analytic tools that might help bound complex environments.

2 - Cultural Geography in Stability Operations Modeling

Leroy (Jack) Jackson, Senior Analyst & Deputy Director, US Army TRADOC Aalysis Center, P.O. Box 8695, Monterey, CA, 93933, United States of America, lajackso@nps.edu

This presentation will describe modeling the civilian population in order to understand the response of the population to insurgent, government and stability force actions. The model represents a conflict ecosystem as described by Dr. David J. Kilcullen in his Counterinsurgency in Iraq: Theory and Practice, 2007 report. Models and algorithms in the agent-based model are implementations of selected social theories.

3 - Today's Russia - A Peer Competitor?

Michael Horn, Senior Defense Analyst, The Boeing Company, 1215 S Clark Ste, Suite 300, MC 793C-G029, Arlington, VA, 22202, United States of America, michael.r.horn@boeing.com

This study examines when Russia could become a peer challenger to the US. To define peer challenger, we use two DoD constructs: the instruments of national power (Diplomatic, Informational, Military, Economic, or "DIME") and the challenges quadrant (Irregular, Catastrophic, Disruptive, Traditional). We identify how Russia could challenge US interests over time in each quadrant using every element of DIME and determine if Russia fulfills the criteria to be considered a peer challenger.

■ MD24

C-Room 30E, Upper Level

Human Network Analysis: Social Networks in Conflicts

Sponsor: Military Applications Society
Sponsored Session

Chair: Richard F Deckro, Professor of Operations Research, Air Force Institute of Technology, AFIT/ENS; Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, richard.deckro@afit.edu

1 - Beyond Clustering: A Likelihood Approach to Detecting Community Structure

Greg Michaelson, University of Alabama, 186 7th St SW, Vernon, AL, 35592, United States of America, gvmichaelson@crimson.ua.edu, Marcus Perry

The graph partitioning problem has been around for centuries, but has, in recent years, has become the topic of intense research in diverse fields, from computer science to physics to the social sciences. Most efforts have focused on identifying, dense, yet sparsely interconnected clusters. We suggest that this definition of community structure is unacceptably limiting, and propose a likelihood framework for distinguishing significant community structure from structures due to randomness.

2 - A Probabilistic Programming Approach in the the Analysis of Social Networks

Ed Pohl, University of Arkansas, Department of Industrial Engineering, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, epohl@uark.edu, Mauricio Guzman

This study investigates the impact that uncertainty in the relationships among actors or members in a network has on the analysis of the social network.

Probabilistic programming is used to model the effects of uncertainty in the network. The models with uncertainty show a threshold for which the results are robust and consistent with the deterministic case.

3 - A New Random Graph Generation Algorithm Designed for Social Network Analysis

James Morris, Department of the Air Force, 4180 Watson Way, Wright-Patterson AFB, OH, 45433, United States of America, James.Morris@WPAFB.AF.MIL, Jerome O'Neal, Richard F Deckro

Available random graph generation algorithms suffer from tendencies to generate disconnected graphs and to connect hubs directly. We present a new algorithm, the Prescribed Node Degree, Connected Graph (PNDCG) Algorithm, designed to generate weakly connected social networks with extensions to impact clustering coefficients and assortative mixing within the network. Empirical test results demonstrate the capability of the PNDCG Algorithm to produce networks with the desired properties.

■ MD25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Propagation of Flight Delays and Passenger Impacts II

Sponsor: Aviation Applications & Transportation Science and Logistics

Sponsored Session

Chair: Vikrant Vaze, Massachusetts Institute of Technology, 77, Massachusetts Avenue, Room No. 1-245, Cambridge, MA, 02139, United States of America, vikrantv@mit.edu

1 - Re-Booking Disrupted Airline Passengers While Uncertainty Still Remains

Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu, Lindsey Selegue, Divakar Viswanath

When a flight is extensively delayed (e.g. due to a mechanical problem), one alternative is to re-book passengers onto other itineraries. We investigate the impact of uncertainty (both on the repair time for the originally delayed flight and also potential future disruptions to other flights) on the passenger re-booking decision.

2 - Robust Airline Scheduling: Insights From an Empirical Analysis

Virot Chiraphadhanakul, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, virot@mit.edu, Cynthia Barnhart

We present some insights gained from studying several robust scheduling models including flight re-timing, aircraft re-routing, and block time adjusting, and their variants. We compare the performance of each model based on passenger-centric metrics and delay propagation and reveal trade-offs among them. The computational results are obtained from both actual historical data from an airline and output from simulation which takes into account potential recovery during the day of operation.

3 - Spatial and Temporal Examination of Propagated Flight Delays

Andrew Churchill, Graduate Research Assistant, University of Maryland, Dept of Civil Engineering, 1173 Martin Hall, College Park, MD, 20742, United States of America, churchil@umd.edu, David Lovell

Because aircraft typically operate several flights scheduled in close sequence to one another on a single day, propagation of delays between flights can have a serious impact on operations. We use a large database of historical records of individual flight records to identify where and when original delays occur. Delay for each flight is then categorized as either original or propagated. The spatial and temporal relationships between the original and subsequent propagated delays are examined.

4 - Efficient Utilization of National Air Transportation System Capacity

Vikrant Vaze, Massachusetts Institute of Technology, 77, Massachusetts Avenue, Room No. 1-245, Cambridge, MA, 02139, United States of America, vikrantv@mit.edu, Cynthia Barnhart

Frequency-based competition among US domestic airlines has led to decreasing aircraft sizes, causing airports to operate at levels close to capacity. We formulate and solve the problem of efficient utilization of available capacity as a mixed integer linear program to obtain a lower bound on system delays. Next we assess the effects of the control mechanisms and incentives on various stakeholders including passengers and airlines.

■ MD26

C-Room 31B, Upper Level

Joint Session AAS/TSL: Airport Collaborative Decision Making in the US

Sponsor: Aviation Applications & Transportation Science and Logistics

Sponsored Session

Chair: Yu ZhangAssistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, yuzhang@eng.usf.edu

1 - Modeling and Control of Airport Taxi Processes for Emissions Reduction

Ioannis Simaiakis, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 35-217, Cambridge, MA, 02139, United States of America, ioa_sim@mit.edu, Hamsa Balakrishnan

Aircraft taxiing for takeoff contribute significantly to the fuel burn and emissions at airports. This talk investigates the possibility of reducing fuel burn and emissions from surface operations through a reduction of the-out taxi times of aircraft. We propose a model that treats aircraft taxi-out processes as a series of queues, and demonstrate that the model can be used to predict taxi-out times. We also illustrate how taxi times can be reduced through improved queue management strategies.

2 - Challenges Facing Realization of Trajectory-based Surface Operations at Major Airports

Victor Cheng, Dr., Optimal Synthesis Inc., 95 First Street, Suite 240, Los Altos, CA, 94022, United States of America, vcheng@optisyn.com

Airport congestion is a major problem of the National Airspace System, especially at major airports with complex layouts. Trajectory-Based Surface Operations (TBSO) is a concept that enables more efficient aircraft movement. Technical challenges for TBSO include development of automation systems for tower controllers to plan the 4D-trajectory operations, and flight-deck automation to execute the 4D-trajectory clearances with the expected level of precision.

3 - Collaborative Departure Queue Management Algorithm Design and Testing

Christopher Brinton, President/Principal Analyst, Mosaic ATM Inc., 801 Sycolin Rd., Suite 212, Leesburg, VA, 20175, United States of America, brinton@mosaicatm.com, Stephen Atkins

During periods of high demand, long queues of aircraft form at the departure runways, causing unnecessary fuel burn and substantial environmental impact. However, to reserve a departure slot, each flight must push-back and physically occupy a spot in the line. The CDQM concept meters departures while providing flexibility to flight operators. This paper addresses the CDQM algorithm, which allocates departure capacity amongst flight operators, and results of field testing of the CDQM concept.

■ MD27

C-Room 31C, Upper Level

Supply Chain Simulation II

Sponsor: INFORMS Simulation

Sponsored Session

Chair: Scott Grasman, Missouri S&T, Rolla, MO, 65409, United States of America, grasmans@mst.edu

1 - A Simulation-based Methodology for VRP with Stochastic Demands

Javier Faulin, Associate Professor, Public University of Navarre, Dept of Statistics and OR, Campus Arrosadia, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es, Angel Juan, Scott Grasman

The SR-GCWS-CS is a hybrid algorithm developed by the authors to solve the Capacitated Vehicle Routing Problem (CVRP). This algorithm combines the Clarke and Wright Heuristic with Monte Carlo Simulation and splitting techniques to generate a set of alternative pseudo-optimal solutions for the CVRP. As an evolution of previous work, we present here a variant of this algorithm that can be used to solve Vehicle Routing Problems with Stochastic Demands (VRPSD).

2 - Quantification of the BWE: The Case of Small-sized Companies
Martha Centeno, Associate Professor, Florida International University, 10555 W. Flagler St, EC 3145 - ISE Department, Miami, FL, 33174, United States of America, centeno@fiu.edu, Jaime Perez

We have analyzed the interaction between demand management strategies and forecast methods on BWE, using a simulation model. Five factors were considered: demand management strategy, forecast method, Lead Time, seasonality, and ordering policy. Response variables were BWE index and total cost. Results indicate that no demand management strategy dominates under all conditions. Collaborative demand management seems best for low seasonality regardless of the forecasting method and lead time nature.

3 - Simulation-based Optimization of AGV Capacity
Abhijit Gosavi, Missouri S & T, 219 Enginnering Management, Rolla, United States of America, gosavia@mst.edu, Scott Grasman

Optimization of AGV capacity has not been studied in the literature extensively. Most of the existing models are analytical and make restrictive assumptions about the system. We present a simulation-based optimization model that can be used to optimize the capacity of a single-vehicle stochastic system. We obtain encouraging numerical results.

■ MD28

H-Room 500, Fifth Floor

New Directions in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. Geroge Street, Toronto, ON, M5S3E6, Canada, ming.hu@rotman.utoronto.ca

1 - Price Dynamics under Limited Information
Omar Besbes, Columbia University, Graduate School of Business, 3022 Broadway, Uris Hall, New York, 10027, United States of America, ob2105@columbia.edu, Assaf Zeevi

We consider a single product pricing problem in an uncertain demand environment and analyze price dynamics in the presence of three key elements: recalibration, demand model mis-specification and competition. We illustrate how price instability can arise as a result of the interplay of at least two of these elements.

2 - Contracting with Forecast Updates and Asymmetric Information
Ozge Sahin, Assistant Professor, University of Michigan, Stephen M Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, ozge@bus.umich.edu

The goal of the research is to investigate the value of forecasting in a decentralized supply chain. We consider a two period, single retailer and single supplier problem. The retailer's type and subtype after the forecast update are her private information. We compare and contrast three contract types for a Bayesian updating supplier and retailer.

3 - Designing Post-Sales Services for a Broader Market
Julie Ward, Hewlett-Packard Labs, 1501 Page Mill Rd, Palo Alto, CA, 94304, United States of America, jward@hp.com, Jose Luis Beltran, Enis Kayis, Filippo Balestrieri, Guillermo Gallego, Ming Hu, Ruxian Wang, Shailendra Jain

We present several new service concepts, such as monthly billed warranties and warranty options. These new services have more attractive cash-flow characteristics than traditional warranties, and in some cases may provide more flexibility to respond to technological innovations in the marketplace. Further, these services may differ in their net cost depending on usage rate, enabling greater market share and profitability across a heterogeneous population of customers.

4 - Monotone Approximation of Decision Problems
Thomas Weber, Assistant Professor, Stanford University, Terman Engineering Center, Stanford, CA, 94305-4026, United States of America, webert@stanford.edu, Naveed Chehrazi

Many decision problems have the structural property that the objective function is a composition of different component functions which can be identified using empirical data. We consider the approximation of such objective functions, subject to monotonicity constraints. Using a constrained B-spline approximation we provide a data-driven robust optimization method for environments that can be sample-sparse. The method is illustrated for optimal debt settlement in the credit-card industry.

■ MD29

H-Room 501, Fifth Floor

Wind Power

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Antonio J. Conejo, Professor, University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, antonio.conejo@uclm.es

1 - The Value of Compressed-Air Energy Storage (CAES) with Transmission-Constrained Wind
Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu, Paul Denholm

We examine the potential advantages of co-locating wind and CAES in order to increase transmission utilization and decrease transmission costs. Co-location of wind and CAES decreases transmission requirements, but also decreases the value of CAES compared to locating storage at the load. We examine three 'wind by wires' scenarios in the United States with a variety of transmission and CAES sizes to estimate the transmission costs required to justify co-locating CAES with wind.

2 - A Methodology to Generate Correlated Wind Speed Scenarios
Juan Miguel Morales, Engineer, University Castilla-La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, JuanMiguel.Morales@uclm.es, Roberto Mînguez, Antonio J. Conejo

This paper provides a methodology to characterize wind speed uncertainty at different sites via scenarios. These scenarios are to be used within stochastic programming models to make informed decisions on wind power production. Each scenario embodies time dependencies and is spatially correlated with the scenarios describing other wind stochastic processes. A comprehensive case study is used to illustrate the capabilities of the proposed methodology. Appropriate conclusions are finally drawn.

3 - Some Impacts on Electricity Markets Given Integration of Large-Scale Wind Generation
William (Bill) Rosehart, University of Calgary, Department of Electrical and Computer Eng., Calgary, Canada, rosehart@ucalgary.ca, John MacCormack, Hamid Zareipour, Aidan Hollis

This work examines the effects of large-scale integration of wind generation. Hourly dispatch models of wind generation, load and resultant residual demand are combined with a probabilistic model of non-wind generator availability, a model of an energy-only market with a price cap, and a model of generator costs and dispatch behavior. The work evaluates the effect on electricity prices, reliability, and the fixed cost recovery of non-wind suppliers at different levels of wind penetration.

4 - Modeling of Flexibility in Power Systems with Large Amounts of Wind Power
Aidan Tuohy, University College Dublin, Belfield, Dublin 4, Ireland, aidan.tuohy@ucd.ie, Mark O' Malley

As wind power installed on a power system increases, the flexibility of the power system to deal with large amounts of this variable energy source becomes more important. Therefore, correct modelling of operation of flexible resources is needed. The flexibility of a power system is examined, looking at elements such as conventional plant, storage, interconnection, demand side resources, transmission and market operation. The effect of operational policies for these elements is presented.

■ MD30

H-Room 502, Fifth Floor

Forestry VI: Biofuel Supply Chain

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Hayri Onal, Department of Agricultural and Consumer Economics, Univeristy of Illinois, Urbana-Champaign, Urbana, IL, 61801, United States of America, h-onal@uiuc.edu

1 - Consideration of Agricultural and Energy Market Dynamics in Analysis of Biofuels Market Penetration
Ozge Kaplan, U.S. Environmental Protection Agency, Research Triangle Park, NC, United States of America, kaplan.ozge@epa.gov

This study examines feedbacks between agriculture production, energy supply, and environmental quality through linking an energy and environment modeling system (U.S. EPA's Markal model) with an ag-econ modeling system (FAPRI suite of models). We analyze the impact of biofuels while incorporating

the interactions between energy and agricultural markets, and investigate specifically how this interaction influences the development of the market for biomass feedstocks.

2 - Understanding the Evolving Supply Chain of Biofuels: The Case of Jatropha Curcas

Ahu Soylu, Management Science and Operations, London Business School, London, United Kingdom, asoylu.phd2006@london.edu

This paper examines the operational risks in the dynamic and emergent nature of the supply chain of biofuel from Jatropha curcas. A simulation model has been developed for the supply chain from plantations to refineries and different operational models, managed plantations and contract farming, are compared under different scenarios.

3 - Strategic Biofuel Supply Chain Design under Uncertainty

Yongxi Huang, PhD candidate, University of California, Department of Civil Engineering, Davis, CA, 95616, United States of America, yxhuang@ucdavis.edu, Yueyue Fan

A sustainable energy infrastructure system serves long-term societal needs and must be able to suitably adapt to future changes and more importantly hedge against future uncertainties. We formulate a multistage model for optimal design and operation of a biofuel supply chain system, in order to enhance the system reliability and efficiency of the entire ethanol supply chain over time.

4 - Cournot Competition in Biofuel Production with Government Support

Xiangrong Liu, PhD Candidate, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, xl35@drexel.edu, Hande Benson

The biofuel boom, leading to a jump in food prices due to the diversion of farms' land assignments, motivates our investigation on the effect of government support on farms' production planning. A bilevel model with Cournot competition among two farms with two usages is extended to an MPEC model considering multiple farms with multiple alternatives

■ MD31

H-Room 503, Fifth Floor

Tutorial: Learning and Earning in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Assaf Zeevi, Professor, Columbia University, Graduate School of Business, Uris Hall, Room 406, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

1 - Learning and Earning in Revenue Management

Assaf Zeevi, Professor, Columbia University, Graduate School of Business, Uris Hall, Room 406, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

Most studies in the OR/MS literature, including revenue management, consider settings where model primitives are assumed to be known a priori to the decision maker. In practice, this is rarely the case. We will describe several problems where full information on the underlying market characteristics is lacking and must be inferred indirectly via market response to any given price, which in turn is confounded by statistical noise. In this situation the decision maker confronts a trade-off between exploration of the demand environment (learning) and expected immediate profit (earning). Some approaches to handling such problems, including relevant analytical tools, will be surveyed in this talk.

■ MD32

H-Room 504, Fifth Level

Statistics of Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Jianqing Fan, Frederick L. Moore Professor of Finance, Princeton University, Dept of Operations Res & Fin. Eng., Princeton University, Princeton, NJ, 08540, United States of America, jqfan@princeton.edu

1 - Minimum Autocorrelation Functionals for Anomaly Detection in Dynamical Systems

Alexandre d'Aspremont, Princeton University, Dept of Operations Res & Fin Eng, Princeton University, Princeton, NJ, 08544, United States of America, aspremon@princeton.edu, Marco Cuturi, Jean-Philippe Vert

We propose new methodologies to detect anomalies in discrete-time processes taking values in a set Z. The method is based on the inference of functionals whose evaluations on successive states visited by the process have low autocorrelations. Deviations from this behavior are used to flag anomalies. The candidate functionals are estimated in a subset of a reproducing kernel Hilbert space associated with Z.

2 - Testing and Detecting Jumps Based on a Discretely Observed Process

Yingying Fan, Assistant Professor, University of Southern California, IOM Department, BRI 401B, University of Southern California, Los Angeles, CA, 90089, United States of America, fanyingy@marshall.usc.edu, Jianqing Fan

We propose a new nonparametric test for detecting jumps in asset prices using discretely observed data. Compared to the test in Ait-Sahalia and Jacod(2007), our test enjoys the same asymptotic properties but has smaller variance. These results are justified both theoretically and numerically. Thanks to the variance reduction, we also propose a new test procedure to locate the jumps. Jump identification problem thus reduces to a multiple comparison. We employ FDR approach to control type I error.

3 - Asset Pricing Tests in Short Panels

Robert Kimmel, Associate Professor, Ohio State University, Department of Finance, Ohio State University, rkimmel@chicagobooth.edu

Factor pricing models are used for performance evaluation, portfolio optimization, active risk budgeting, and style analysis. Most tests of factor models require a panel of returns with a longer size in the time dimension than in the cross-sectional dimension. Most datasets violate this requirement, so standard practice is to test the model on portfolio rather than individual asset returns. We provide an innovative way to test factor models with individual stock data instead of portfolios.

4 - Nonparametric Estimation for Levy-Type Processes

Song Chen, Professor, Iowa State University, Ames, IA, 50011-1210, United States of America, songchen@iastate.edu

We propose a nonparametric approach to estimating the drift, the scale, the mean of the Poisson process that describes the numbers of jumps, and the jump size distribution for Levy-type processes. Levy-type processes gneralize the continuous Gaussian component of Levy processes to a stable distribution. We show that methods based on regression and nonparametric deconvolution can be used for inference for the Levy-type processes.

■ MD33

H-Room 505, Fifth Floor

Empirical Research

Cluster: Economic Models in Operations Management
Invited Session

Chair: Vinayak Deshpande, Associate Professor, Purdue University, Krannert School of Management, 100 S Grant Street Rawls Hall 4022, West Lafayette, IN, 47907-2076, United States of America, vinayak@purdue.edu

1 - Data Analysis and Supply Chain Design for a Company

Ananth Iyer, Purdue University, 403 W. State Street, West Lafayette, IN, United States of America, aiyer@purdue.edu, Arun Radhakrishnan

We describe analysis of a individual item level dataset for a consumer product across a supply chain. The data analysis showed the time spent at each stage of the supply chain by individual units of product. Understanding supply chain flows enabled a supply chain design model to improve performance. Managerial insights from the model were then used to implement operational level changes. Insights from the model are now being generalized.

2 - Can Stock Price Movements Inform Operational Improvement Efforts?

Kamalini Ramdas, Professor, London Business School, kramdas@london.edu, Wei Li, Marc Lipson, Jonathan Williams

We examine whether stock price movements can be used to inform operational improvement efforts, in the context of the airline industry. Using data from the major US carriers, we examine the impact on stock prices of the key dimensions of airline service quality, and use this analysis as a source of suggestions for quality improvement efforts.

3 - Sales Forecasting with Financial Indicators and Experts' Input

Nikolay Osadchiy, PhD Candidate, New York University, 44 West 4th St, New York, NY, 10012, nosadchi@stern.nyu.edu, Vishal Gaur, Sridhar Seshadri

We model sales of a retailer as a function of the sales forecast, the term of the forecast, and the return on a broad market index over the term of the forecast. The empirical estimation of the model shows that a significant part of forecast errors can be explained by the market return. We present a method of augmenting the sales forecasts with market returns and improving their accuracy. The accuracy improvement can exceed 15% in the out-of-sample tests and lead to substantial profit increase.

4 - An Empirical Estimation of the Impact of Airline Flight Schedules on Flight Delays

Vinayak Deshpande, Associate Professor, Purdue University, Krannert School of Management, 100 S Grant Street Rawls Hall 4022, West Lafayette, IN, 47907-2076, United States of America, vinayak@purdue.edu, Mazhar Arikan

Airline flight delays have come under increased scrutiny lately, with FAA data revealing that airline on-time performance was at its worst level in 13 years in 2007. Our goal is to examine the impact of the scheduled time block allocated for a flight on on-time arrival performance. We combine empirical flight data published by BTS, with the Newsvendor framework from the Operations literature to conduct this analysis. Our results show that airlines systematically under-schedule flights.

■ MD34

H-Room 520, Fifth Floor

Modeling Decision Making in Humanitarian Relief Operations

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch

1 - When Should a Non-Profit Firm Accept a Donation?

Hugh Medal, Doctoral Student, Industrial Engineering Department, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hmedal@uark.edu

Due to manpower and capacity constraints, a non-profit firm often cannot accept every donation. Hence, when a donation is offered, a decision must be made: how much should be accepted? Factors such as the cost of accepting the donation, anticipated future donations, and anticipated future demand influence this decision. In this study we present a model to aid non-profit firms in making the decision of whether or not to accept a particular donation when it is offered.

2 - An Analysis of Fundraising Strategies for Disaster Relief Operations

Tina Wakolbinger, University of Memphis, Fogelman College of Business 332, Memphis, TN, 38152, United States of America, t.wakolbinger@memphis.edu, Fuminori Toyasaki

Aid agencies involved in disaster relief are currently facing multiple changes and 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 strategies to deal with these trends. Using game-theory, we analyze the impact of three aid agencies' strategies: cooperation, differentiation, and allowing donors to earmark donations.

3 - Planning World Food Program Operations in the Somali Region of Ethiopia

Jarrod Goentzel, Exec Dir, MLOG Program, MIT, 77 Massachusetts Ave. E40-211, Cambridge, MA, 02139, United States of America, goentzel@MIT.EDU

WFP transports aid amidst insecurity in the Somali region of Ethiopia. We assess methods to mitigate risk, such as escorted convoys, and analyze the impact on transportation rates and transit time. We then use the Analytic Hierarchy Process to locate warehouses that expedite flows from port to beneficiary. The process of identifying and prioritizing objectives and of developing measures for various criteria yielded insights that could be useful for decision-making in other humanitarian contexts.

4 - System Dynamics Modeling of Humanitarian Relief Operations

Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch

Humanitarian organizations face increased challenges scaling capacity, improving operational efficiency, and operating in challenging environments. To address such challenges, managers in humanitarian organizations must understand the complexity characterizing relief operations. Yet, learning in such environments is difficult. The system dynamics approach provides managers with a set of tools that can help them systematically explore new strategies and better understand complex systems.

■ MD35

H-Sapphire A, Fourth Floor

Optimization in Radiotherapy II

Sponsor: Health Applications
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 Discrete-time Optimal Control Approach to Spatio-temporal Radiotherapy Planning

Archis Ghate, Asisstant Professor, Industrial and Systems Engineering, University of Washington, Seattle, WA, 98195-2650, United States of America, archis@u.washington.edu

Current state of the art in radiotherapy planning breaks planned dose into constant dose fractions delivered over several weeks. Spatial dose distribution over multiple organs at risk and tumor(s) is separately optimized a priori. We propose a novel spatio-temporal approach that exploits emerging advances in quantitative functional imaging. Specifically, we develop a discrete-time optimal control formulation to choose plans that react adaptively to patient's actual radiobiological response.

2 - Intra-fraction Motion in Intensity Modulated Radiation Therapy

Ehsan Salari, Ph.D. Student, University of Florida, ISE Department, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, esalari@ufl.edu, Edwin Romeijn

Patient motion during radiation treatment can compromise the quality of a treatment plan. Modeling and accounting for this uncertainty is challenging due to the potential asynchrony between the apertures used to deliver dose and movements of the organs. We propose a stochastic model that allows us to study the impact of the intra-fraction motion on the delivered dose distribution. This model can also be used as a basis for finding treatment plans that explicitly account for patient motion.

3 - Optimization Models for Radiation Therapy under Uncertainty

Fei Peng, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, feipeng@umich.edu, Edwin Romeijn, Mustafa Sir, Marina Epelman

In intensity-modulated radiation therapy for cancer, treatment is designed to deliver high radiation doses to tumors, while avoiding healthy tissues. Due to random shifts during treatment, significant differences between the dose derived via optimization-based treatment planning and the actual dose delivered can occur. We present optimization models that take these types of uncertainty into consideration as well as adapt the treatment in an off-line manner, and present experimental comparisons.

4 - Image Guided 4-D Optimization for IMRT

Behlul Saka, Ph.D. Student, Graduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu, Mark Langer, Ronald L. Rardin

In a clinical environment, the time span of a patient's radiation therapy is on the order of weeks which include 30-50 fractions rather than one big event. 4-D Intensity Modulated Radiation Therapy (IMRT) planning incorporates tumor changes across fractions provided by "Image Guided Radiation Therapy (IGRT)" technology. We present optimization models that update the treatment plans after every sub-sequence of fractions, and test our approaches on the simulated real world cases.

■ MD36

H-Sapphire B, Fourth Floor

2009 Pierskalla Competition Papers III

Sponsor: Health Applications
Sponsored Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

1 - Methicillin-Resistant S. Aureus Transmission Reduction Using Agent-Based Modeling and Simulation

Bruce Golden, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, bgolden@rhsmith.umd.edu, Sean Barnes, Ed Wasil

Methicillin resistant S. aureus (MRSA) is a significant ongoing problem in healthcare, causing many downstream effects, such as a longer length of stay for patients, higher costs, and fatalities. An agent-based simulation model is

developed to investigate the dynamics of MRSA transmission in a hospital. The simulation model is used to examine the effectiveness of various infection control procedures and to explore more specific questions relevant to hospital administrators and policymakers.

2 - Hedging Against Antiviral Resistance During the Next Influenza Pandemic Using a Secondary Antiviral

Joseph Wu, Assistant Professor, University of Hong Kong, 21 Sassoon Rd, Pokfulam, Department of Community Medicine, Hong Kong, Hong Kong - PRC, joewu@hku.hk

Many countries are stockpiling a single antiviral (Tamiflu) in anticipation of large-scale antiviral intervention during an influenza pandemic. The effectiveness of antiviral intervention is attenuated if antiviral resistance emerges and spreads due to the associated selective pressure. We use a stochastic mathematical to show that the spread of drug-induced antiviral resistance can be significantly reduced by using a small stockpile of a secondary antiviral.

3 - A Game-theoretic Framework for Estimating the Willingness-to-Pay for Health and for Expansion

Reza Yaesoubi, PhD Candidate, North Carolina State University, Campus Box 7906, 421 Daniels Hall, Raleigh, NC, 27511, United States of America, ryaesou@ncsu.edu

We propose a game-theoretic framework for estimating the willingness-to-pay (WTP) for health in markets where the health purchaser offers a menu of medical interventions, and each individual selects the intervention that maximizes her utility. The framework also introduces a measure for estimating the WTP for expanding the utilization of medical interventions. The numerical results from applying the framework to Colorectal Cancer screening tests will be presented.

■ MD37

H-Sapphire C, Fourth Floor

Understanding Operations as an Investor

Sponsor: MSOM/ Supply Chain

Sponsored Session

Chair: Vishal Gaur, Associate Professor, Johnson School, Cornell University, vg77@cornell.edu

1 - Do Equity Analysts (fully) Incorporate Inventory Information in Their Sales and Earnings Forecasts?

Saravanan Kesavan, Assistant Professor, University of North Carolina, CB #3490, McColl Building, Chapel Hill, 27516, United States of America, skesavan@unc.edu

This talk draws on research conducted for two separate projects that investigated the role of inventory in predicting sales and earnings for retailers. The primary focus of this talk is to investigate if equity analysts incorporate the inventory information in their sales and earnings forecasts of retailers. We find that anaysts' forecasts are significantly biased due to missing information contained in inventory.

2 - Ordering Decisions, Cost of Capital, and the Value of the Firm

Santiago Kraiselburd, Zaragoza Logistics Center, Gomez Laguna 25, 1, Zaragoza, Spain, skraiselburd@zlc.edu.es, Alejandro Serrano, Rogelio Oliva

We present a model of a firm where the equity cost of capital depends on the operational decisions. We give an expression for linking the cost of capital and the ordering quantities and study the mechanisms through which this interaction takes place. Using the CAPM, we find that, if risk comes from exogenous shocks, investor's risk decreases with order quantity and risk-averse investors should behave as risk-neutral agents. Our results call into question the usual approaches to assessing risk.

3 - Stock Price Implications of Operations Disruptions

William Schmidt, Doctoral Student, Harvard Business School, Wyss House, Boston, MA, 02163, United States of America, wschmidt@hbs.edu

We present findings of an empirical investigation into the sizes and time-series correlation of operations disruptions, and their impact on company enterprise value and stock price volatility. Results from a large sample event study are presented. Quantitative results are augmented with descriptive information gathered from case study research.

4 - Stock Market Pressure on Sales Reporting and Inventory Investment

Guoming Lai, McCombs School of Business, University of Texas, Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, guomingl@andrew.cmu.edu, Laurens Debo, Lin Nan

We study a game between a self-interested manager and rational investors. The manager is compensated based on the stock price and may manipulate the stock price by channel stuffing. Investors infer the amount of sales padded. We identify three factors that determine the manager's incentive on channel stuffing: the marginal effect, the boundary effect and the carryover effect. Moreover, we find that the manager may under- or over-invest inventory, both possible.

■ MD38

H-Sapphire D, Fourth Floor

Stochastic Dynamic Inventory Models

Cluster: Inventory Management

Invited Session

Chair: Qing Li, Associate Professor, Hong Kong University of Science and Technology, Dept of ISOM, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, imqli@ust.hk

1 - Inventory Control with Partial Batch Ordering

Tarkan Tan, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Pav F7, Eindhoven, 5600 MB, Netherlands, t.tan@tue.nl, Osman Alp, Tim Huh

We consider an infinite horizon, periodic-review single item production/inventory system with random demand and batch ordering, where a separate fixed cost is associated for ordering a batch. We allow the possibility of partial batches. We introduce an alternative cost accounting scheme to analyze the problem and we discuss several properties of the optimal solution. We also propose three heuristic policies, all of which perform very well for a wide range of problem parameters.

2 - Managing Supply Chain Inventory with Stock Disposals

Alexandar Angelus, Associate Professor, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, #04-90, Singapore, 178899, Singapore, angelus@smu.edu.sg

We analyze a multiechelon model where the firm can dispose of stock at each stage in the supply chain. Stock disposals complicate the system, so that the Clark and Scarf (1960) approach no longer applies. We find conditions under which it is optimal to never: (i) dispose of stock; (ii) both dispose of stock and order inventory. We identify a class of disposal policies that achieves the Clark-Scarf decomposition and reduces the optimal inventory policy to the classical echelon base stock policy.

3 - Optimal Control of Inventory Systems with Concave Ordering Costs

Yimin Yu, PhD Student, Industrial and Systems Engineering, University of Minnesota, 111 Church St. S.E., Minneapoolis, MN, 55455, United States of America, yimin@me.umn.edu, Saif Benjaafar

In this talk, we analyze inventory systems with concave ordering costs. We introduce a local monotone property for the optimal policy and a new generalized convexity property to show that the structure of the optimal policy for systems with piecewise linear concave ordering costs is a generalized (s,S) policy. We carry out the analysis under quite general assumptions on ordering costs and demand distributions.

4 - Optimal Policies for a Capacitated Series System

Wanshan Zhu, Assistant Professor in Operations Management, Singapore Management University, 50 stamford #0401, Singapore, 178899, Singapore, adamzhu@smu.edu.sg, Alexandar Angelus

We generalize the known two-echelon capacitated results of Parker and Kapuscinski (2004) to a capacities series system with arbitrary echelon. We prove that when the lowest capacity is at the bottom echelon and the capacity is tight, a branch echelon base stock policy is optimal and achieves the Clark-Scarf (1960) decomposition of the cost function. A numerical example evaluated for a three-echelon capacitated system illustrates the results and provides insight into the "push-ahead" effect.

■ MD39

H-Sapphire E, Fourth Floor

Operations Management in the Process Industries

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, krajaram@anderson.ucla.edu

1 - Interaction Between Technology and Extraction Scaling Real Options in Natural Gas Production

Paul Enders, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, penders@cmu.edu, Alan Scheller-Wolf, Nicola Secomandi

We analyze the interaction between the real options to scale the levels of employed extraction and communication technologies and the extraction rate using real data from Equitable Resources, a U.S. natural gas production company. We find that the values of these real options are highly interdependent and their optimal use is rather complex. We bring to light data-driven managerial principles guiding the use of these real options.

2 - A Multi-period Stochastic Inventory Model with Capacity Reservation

Youssef Boulaksil, Eindhoven University of Technology, P.O. Box 513, Pav E17, Eindhoven, 5600 MB, Netherlands, Y.Boulaksil@tue.nl, Jan Fransoo, Tarkan Tan

We consider a pharmaceutical firm that faces uncertain demand and that has to reserve capacity at its supplier, which produces on a non-dedicated production line. The firm also faces uncertain capacity, as reserved capacity slots are subject to (partial) rejection. A multi-period, periodic review inventory system is considered and we develop a dynamic programming model for this problem and show the structure of the optimal policy. Our numerical results reveal interesting managerial insights.

3 - Stochastic Facility Location in the Process Industry

Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, krajaram@anderson.ucla.edu, Jens Wollenwebber, Felipe Caro

We consider the facility location problem in the process industry. This problem differs from the traditional facility location problem due to characteristics that are unique to the process industry. We model this problem as a non-linear, mixed-integer program. We develop heuristics and bounds and applied our methods to data from a large food processing company. We show that our methods could potentially increase profits significantly.

4 - Carrier Allocation under Diesel Price Uncertainty

John Turner, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, jgt@andrew.cmu.edu, Sunder Kekre, Benjamin Peterson, Soo-Haeng Cho, Alan Scheller-Wolf

Motivated by recent swings in diesel prices, we study the problem of allocating full truckload carriers to transportation lanes in the presence of diesel price uncertainty. We allow carriers to specify their fuel surcharge schedules, as well as a fuel surcharge cap beyond which fuel surcharges are not levied. Going forward, a decision support tool based on our model will be used by a large U.S. retailer to price and negotiate contracts with its carriers.

■ MD40

H-Sapphire H, Fourth Floor

Numerical Methods for Stochastic Control Problems in Finance

Sponsor: Financial Services
Sponsored Session

Chair: Stathis Tompaidis, Associate Professor, University of Texas at Austin, McCombs School of Business, IROM Department, Austin, TX, 78712, United States of America, Stathis.Tompaidis@mccombs.utexas.edu

1 - A Dynamic Programming View of the Smooth Pasting Condition in Multiple Dimensions

Adam Speight, Assistant Professor, Georgia State University, 197 15th St NW, Atlanta, GA, 30318, United States of America, aspeight@gmail.com

I present a interpretation of the smooth pasting condition based on dynamic programming. Fourier analysis of the smooth-pasting condition shows local changes to the free boundary have negligible effects on the value function. Thus, any local discretization will fail to resolve fine details of the boundary. I develop a preconditioner that renders the smooth pasting condition elliptic, which has a direct probabilistic interpretation in terms of the local time spent near the free boundary.

2 - Moving Boundary Approach to Solving Optimal Stopping Problems

Kumar Muthuraman, Professor, McCombs School of Business, kumar@austin.utexas.edu

This talk will focus on introducing a computational method that can solve a large class of optimal stopping time problems. Using the classical American option pricing problem, we will describe the method. We will then consider the much harder problem of pricing American options when the volatility of the underlying asset price is stochastic. Here we take a canonical setup that is general enough to encompass several stochastic volatility models proposed in literature.

3 - A State Variable Decomposition Methodology for Solving Portfolio Choice Problems

Lorenzo Garlappi, University of Texas at Austin, McCombsr School of Business, Ausitn, TX, 78712, United States of America, lorenzo.garlappi@mccombs.utexas.edu, Georgios Skoulakis

We develop a new method for the solution of discrete-time dynamic portfolio choice problems. The method efficiently approximates conditional expectations of the value function by using a decomposition of the state variables and a Taylor expansion of the value function. We illustrate the accuracy of the method in handling several features of portfolio choice problems.

4 - A Simulation Algorithm for Solving Dynamic Portfolio Choice Problems

Chunyu Yang, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, chunyu.yang@phd.mccombs.utexas.edu

We develop a simulation-based algorithm to solve dynamic portfolio choice problems under constraints by solving the first order, Karush-Kuhn-Tucker (KKT), conditions. To approximate the conditional expectations in the KKT conditions, we apply a functional approximation approach with cross-test-solution regressions and introduce an iterative method to shrink the approximation region. A numerical example with CRRA preferences, an income stream, and margin requirements is provided.

■ MD41

H-Sapphire L, Fourth Floor

Training Technologies for Emergency Preparedness

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

1 - Sand Table Training Methods for Emergency Preparedness

Stephen Guerin, Redfish Group, stephen.guerin@redfish.org

We demonstrate new developments in three-dimensional sand table training using new visualization techniques and agent-based modeling.

2 - Simulation Table Methods for Emergency Preparedness

Charles Curtis, chas@simtable.com

We discuss new methods and applications in simulation-based training technology.

3 - Discussant

Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

■ MD42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS
Invited Session

Chair: Allen Butler, President, Daniel H Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Integrated Framework for Product Costing, Demand Forecasting and Capacity Planning of New Photovoltaic Technology Products

Bex George Thomas, General Electric Global Research, Computing and Decision Science, 1 Research Circle, Niskayuna, NY, 12309, thomasb@ge.com, Srinivas Bollapragada

GE Energy's nascent solar business has revenues of over $100 million, and may exceed $1 billion in the next few years. GE Global Research is pursuing a number of technological alternatives to bring new low cost solar products to the market. We developed analytical decision support tools with embedded mathematical models to estimate product costs and demands, and to support capacity planning decisions in the presence of major uncertainties in technology, costs, demands, and energy policy.

2 - Optimizing Helicopter Transport of Oil Rig Crews at Petrobras

Hernàn Abeledo, Associate Professor, The George Washington University, 1776 G St NW, Washington, DC, 20052, United States of America, abeledo@gwu.edu, Lorenza Moreno, Fernanda Menezes, Nelci Nascimento, Marcus Poggi de Aragão, Oscar Porto, Marcelo Reis, Eduardo Uchoa

Petrobras carries over 1900 workers daily by helicopter to about 80 offshore oil platforms. This operation is among the largest worldwide for civilian helicopters. We present a flight scheduling system designed to improve service and minimize cost. Achievements comprise strict enforcement of safety guidelines, reductions of 18% in number of offshore landings, 8% in total flight time, and 14% in flight costs. The optimization model, involving routing and packing, is solved by column generation.

■ MD43

H-Room 400, Fourth Floor

Managing Supply Uncertainties

Cluster: Supply Chain Models
Invited Session

Chair: Annabelle Feng, Assistant Professor, University of Texas-Austin, McCombs School of Business, 1 Univresity Station B6500, Austin, TX, 78712-0201, United States of America, annabelle.feng@mccombs.utexas.edu

1 - Leadtime, Reliability, and Procurement Cost

Burcu Tan, PhD Candidate, University of Texas at Austin, IROM, B6500, 1 University Station, Austin, TX, 78712, United States of America, Burcu.Tan@phd.mccombs.utexas.edu, Annabelle Feng

We consider an inventory manager who can source from two unreliable suppliers with different lead times. The capacity of each supplier is uncertain upon ordering, which leads to a nonconvex cost evaluation of the ordering strategy. We use DP to explore the optimal procurement strategy for different levels of net inventory, cost parameters, and supplier reliability. We analyze the trade-offs between lead time, reliability and procurement cost in determining the optimal supplier base.

2 - Pricing During Disruptions: A Cause of the Reverse Bullwhip Effect

Ying Rong, University of California-Berkeley, Dept of IEOR, Berkeley, CA, United States of America, yir204@lehigh.edu, Max Shen, Larry Snyder

Because supply disruptions occur infrequently, consumer behavior during disruptions can be difficult to predict, and this poses a great challenge to firms. We examine three different pricing strategies that may be used by a firm that only possesses limited information about its strategic customers. We find that the simplest proposed pricing strategy outperforms the other two in terms of both the stability of the customer order process and the firm's revenue.

3 - New Results on Bargaining Power and Supply Base Diversification

Zhixi Wan, Assistant Professor, HEC Paris, 1, Rue de la Libération, Jouy en Josas cedex, 78351, France, wanzhixi@umich.edu, Damian Beil

We consider a buyer who periodically holds auctions to award short term supply contracts among a cohort of suppliers (i.e., the supply base). To mitigate significant cost shocks to procurement, the buyer can diversify her supply base by selecting suppliers from different regions. We find that the more bargaining power the buyer has the more she prefers a diversified supply base. We also examine the effect of the asymmetry between regions on the buyer's optimal diversification strategy.

■ MD44

H-Room 402, Fourth Floor

Measurement of Value in Services Systems

Sponsor: Service Science
Sponsored Session

Chair: Ruoyi Zhou, Services Research Manager, IBM, 650 Harry Road, San Jose, CA, 95120, United States of America, ruoyi@us.ibm.com

1 - Determining Quantitative Value in Services

Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

We present a step-by-step method to determine the quantitative economic value of business services. The distinction is important, consumer buying behavior is affected by psychological factors. In business the fundamental and dominant criteria for engaging a service provider are grounded on quantitative economic value. Moreover, the decision making units are organizations, not individuals. We present examples. We also discuss the very fundamental difference between price and value.

2 - Customer Lifetime Value in Contractual Settings

Christoph Heitz, ZHAW Zurich University of Applied Sciences, Technikumstrasse 9, Winterthur, Switzerland heit@zhaw.ch, Andreas Ruckstuhl, Marcel Dettling

Service provision is often governed by a contract (e.g. newspaper subscriptions, phone contracts, credit agreements). Typically, such a contract includes rules for preventing the customer to switch to a competitor, and thus influencing the autonomous dynamics of the customer in the marketplace. We analyze the problem of calculation of customer lifetime value (CLV) under general contract structures, and address the problem of estimating the CLV from available customer data.

3 - Value Measurement in Complex Service Systems

Ray Strong, IBM Almaden Research, strong@almaden.ibm.com, Ruoyi Zhou, Tianwei Chen

A Service System is a dynamic configuration of people, processes, and technology in which co-creation of value takes place between a service provider and a client. In complex service systems, either the provider or the client may also be service systems. Contrary to many approaches to measuring value in service systems, our approach is based on the realization that value is not intrinsic to the process but rather depends on the point of view, as exemplified by such abstractions as "win-win.a"

■ MD45

H-Room 410, Fouth Floor

Panel Discussion: Research Priorities in Innovation

Cluster: New Product Development
Invited Session

Chair: Sanjiv Erat, University of California San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, serat@ucsd.edu

1 - Research Priorities in Innovation

Moderator: Sanjiv Erat, University of California San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, serat@ucsd.edu, Panelists: Kamalini Ramdas, Christian Terwiesch, Bruno Cassiman

The panel will feature the new Department Editors of Management Science, Kamalini Ramdas, Christian Terwiesch, and Bruno Cassiman. The discussion shall encompass both priorities for the journal, as well as a broader discussion of the 'burning' research questions in Innovation. The main goal will be to exchange ideas, views, opinions about what areas in Innovation are under-researched and why, and to help spur new research and collaborations.

■ MD46

H-Room 411, Fourth Floor

Joint Session Tech Mgt/NDP: TMS Distinguished Speaker: Marvin Lieberman

Sponsor: Technology Management & New Product Development
Sponsored Session

Chair: Francisco Veloso, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, fveloso@cmu.edu

1 - Perspectives on Technology and Market Entry: Themes From Business Strategy

Marvin Lieberman, Professor of Policy, UCLA, Anderson School of Management, Los Angeles, CA, United States of America, marvin.lieberman@anderson.ucla.edu

A critical issue associated to all new technologies is the decision to enter the market. TMS Distinguished Speaker Marvin Lieberman will present an integrated perspective on the the relation between technology and market entry, connecting topics such as first-mover advantage, imitation processes, disruption, industry life cycle, and implications of the learning curve.

■ MD47

H-Room 412, Fourth Floor

Tutorial: Modeling Static Competitive Facility Location Problems: New Approaches and Results

Cluster: Tutorials
Invited Session

Chair: Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu

Co-Chair: Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5E 3E6, Canada, Berman@Rotman.Utoronto.Ca

Co-Chair: Dmitry Krass, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca

1 - Modeling Static Competitive Facility Location Problems: New Approaches and Results

Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu, Oded Berman, Dmitry Krass, Tammy Drezner

The gravity model applied to competitive facility location is described. We wish to find the locations for new facilities that attract the maximum buying power. Extensions include: modeling uncertainty, minimizing the probability of missing a threshold, flow interception, market expansion and lost demand, allocation of a given budget among one's facilities. Tools include: the generalized Weiszfeld procedure, the big triangle small triangle global optimization, and the tangent line approximation.

■ MD48

H-Sapphire Green Room, Fourth

Workshop: Research Opportunities in Hospitality and Services

Cluster: Hospitality
Invited Session

Chair: Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

1 - Research Opportunities Available via Cornell Center for Hospitality Research

Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu, Liana Victorino

This presentation will provide an overview of resources available at the Cornell University's Center for Hospitality Research (CHR) for conducting a wide range of research projects on topics related to service operations (e.g. revenue management, operations strategy, financial analysis). We will also discuss how corporations can participate in many different activities supported by CHR.

■ MD49

H-Room 300, Third Floor

Workforce Analytics in Service Systems

Cluster: Workforce Engineering and Management
Invited Session

Chair: Gyana Parija, IBM Research, ISID Institutional Area, New Delhi, India, gyana.parija@in.ibm.com

1 - A Bayesian Analysis and Optimization Framework for Optimal Project Staffing

Aleksandra Mojsilovic, aleksand@us.ibm.com, Jianying Hu, Mark Squillante, Afsaneh Shirazi, Moninder Singh

We describe a methodology to determine the impact of various staffing factors on project success and apply it to staff individual projects to maximize an overall business objective. We use Causal Bayesian Network to identify key delivery factors and develop a novel approach for collective delivery optimization by treating each active project as an instance of the model. We test the approach and demonstrate its benefits on actual IBM service delivery data.

2 - Multi-Skilling Workforce in Service Organizations

Rohit Lotlikar, Research Staff Member, IBM - India Research Lab, EGL, Block D, Domlur Ring Rd, Bangalore, KA, 560071, India, rohitmlo@in.ibm.com, Gyana Parija, Sambuddha Roy, Karthik Visweswariah, Kashyap Dixit, Pranav Gupta, Nanda Kambhatla, Debapriyo Majumdar

Cross-training and job rotation programs are common practices for growing and aligning the capabilities of people in a service unit with evolving needs of the marketplace. We describe a solution for developing effective and least-cost cross-training and rotation programs. Our approach involves identifying multi-dimensional skill gaps in the organization and estimating the cross-learnability of various skills by learning from skill and Resume information on practitioners.

3 - A Mathematical Programming Approach to Improve Seat Utilization for Global Service Delivery Systems

Pranav Gupta, IBM - India Research Lab, Vasant Kunj Inst Area, Delhi, India, prguptan@in.ibm.com, Gyana Parija

Physical space and infrastructure are two important cost drivers for any business. Optimum utilization of such resources can bring huge savings. This paper proposes a MIP to improve utilization of "physical seats:", from where an agent delivers services in a 24x7 delivery setting. We solve the problem by decomposing it into a covering problem and a generalized version of 2-D bin packing problem using MOLP technique. Approximation algorithm is proposed for the later problem for large instances.

■ MD50

H-Room 302, Third Floor

Joint Session SpORts/EDU: Teaching Sports Modeling

Sponsor: SpORts & Education
Sponsored Session

Chair: Michael Magazine, University of Cincinnati, Dept of QAOM, Cincinnati, OH, United States of America, magazim@ucmail.uc.edu

1 - HERBIE and DIPS - NLP Modeling of MLB Pitchers' Earned Run Averages in the Classroom

James Cochran, Associate Professor, Louisiana Tech University, College of Business, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

Several baseball analysts have suggested various functional relationships between an MLB pitcher's ERA and his defense independent pitching statistics (the number of homeruns, walks, and strikeouts he yields). These include DIPS (for Defense Independent Pitching Stats) and HERBIE (for HRBB). We discuss our use of NLP modeling in the classroom to examine whether there are superior functional forms of this relationship.

2 - Pedagogy of Quantitative Analysis Via Sports

Jeffrey Ohlmann, University of Iowa, 108 John Pappajohn Business Bldg., Iowa City, United States of America, jeffrey-ohlmann@uiowa.edu

In this talk, I discuss my experience motivating the development of students' quantitative skills using sports. In particular, I will describe a freshman seminar in quantitative analysis, a case study targeted primarily for the MBA audience, and the use of sports examples to teach mathematical programming techniques.

3 - Team Teaching a Sports Statistics Course

Kellie Keeling, Assistant Professor, University of Denver, DCB Department of Statistics, MSC 8952, 2101 S. University Blvd., Denver, CO, 80208-8952, United States of America, kkeeling@du.edu

I will discuss my experiences team teaching a sports statistics special topics course. This course is offered before the fall quarter during a one-week interterm. Specifically I will talk about the purpose of the course, the design of the course instruction, the coverage of statistical topics, and the administration of student assignments.

4 - Teaching Sports Modeling at UC

Michael Magazine, University of Cincinnati, Dept of QAOM, Cincinnati, OH, United States of America, magazim@ucmail.uc.edu

We have been fortunate to start an alliance with ESPN, where they send us problems they would like investigating. This past year we had our first offering with 5 students working on 5 of these projects without ESPN involvement. The course ran for 2 quarters. The first nailing down a detailed problem statement, hypothesis development and data exploration. The second quarter was to analyze data, make corrections, develop conclusions and write reports.

■ MD51

H-Room 303, Third Floor

Mathematical Programming for Clustering

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Yan Jiang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, jiangyan1984@gmail.com

1 - Solving a Capacitated Clustering Problem with GRASP

Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712, United States of America, jbard@mail.utexas.edu, Yumin Deng

This talk presents a GRASP coupled with path relinking to solve a capacitated clustering problem. In Phase I, a heaviest weight edge algorithm and a constrained minimum cut algorithm are used to select seeds for initializing the clusters. A self-adjusting restricted candidate list is then used to guide the assignment of the remaining nodes to obtain a feasible solution. In Phase II, three neighborhoods are explored. Extensive testing was performed on instances up to 100 nodes.

2 - Strategy For Predicting Immunity of Vaccines

Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

This talk focuses on developing methodologies to predict the immunity of a vaccine without exposing individuals to infection. We will describe feature-selection and classification model that Identify distinct gene signatures that can predict the magnitude of T cell response and the antibody response induced by the vaccine. The work is joint with Dr. Pulendran from Emory Vaccine Center.

3 - Spectral Methods in Mining Data Biomedical and Social Networks

Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petros.xanthopoulos@gmail.com, Panos Pardalos

Spectral methods have become very popular as clustering tools in computer vision and more specifically in image segmentation. In this paper we discuss potential application of spectral graph methods into mining information from networks appearing in biomedicine and in the so called small world networks.

4 - A Branch-and-price Algorithm for Clusterwise Linear Regression

Yan Jiang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, jiangyan1984@gmail.com

We present a branch-and-price algorithm for performing clusterwise linear regression. The clusterwise linear regression problem is to find clusters such that the overall sum of squared errors in regression within the clusters is minimal. The proposed algorithm is applied in the retail promotion planning to group products according to their seasonal effects. The pricing problem is a specialized MIP, which is shown to be NP-complete.

■ MD52

H-Room 304, Third Floor

Operations and Marketing Decisions

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Gongtao (Lucy) Chen, Assistant Professor, National University of Singapore, 1 Business Link, NUS Business School, Singapore, 117592, Singapore, bizcg@nus.edu.sg

1 - Dual Sourcing in a Volatile Commodity Market

Mojisola Otegbeye, Graduate Assistant, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States of America, mko3@njit.edu, Jian Yang

We derive procurement policies tailored towards a buyer's risk attitude, where the price of the commodity fluctuates and the buyer seeks an optimal allotment policy for a dual procurement framework. The buyer can source his needs via contract with a supplier and the spot market. A risk sharing contract is proposed for the supplier-buyer relationship. A highlight of our work is the concept of a floating contract price, with the final price contingent on the future realization of the spot price.

2 - Integrated Marketing and Capacity Contracting for Capital-Intensive Service Systems

Yabing Jiang, Fordham University, 113 W 60th St, New York, United States of America, yajiang@fordham.edu, Abraham Seidmann

Effectively managing service facilities is challenging because firms need to maximize capacity utilization and control customer delays at the same time. Traditionally, incentive contracting and operational capacity decisions are made independently and by different parties. Thus these centers often operate at a suboptimal profit level. To tackle the management challenges we take an integrated approach by incorporating operational delay and capacity decisions with the incentive contract design.

3 - Analysis of Marketing and Operations Strategies to Prevent Product Counterfeiting

Gregory DeYong, Student, Indiana University, 1309 E. Tenth St., Bloomington, IN, 47405, United States of America, gdeyong@indiana.edu

We mathematically model strategies to combat the counterfeiting of products by unauthorized manufacturers. The strategies include marketing to reduce the appeal of cloned products, product changes to increase the cost of cloned products and a mixed strategy combining the two approaches. Effectiveness of the strategies is examined.

4 - The Joint Decisions of Price, Quality, and Marketing Effort

Gongtao (Lucy) Chen, Assistant Professor, National University of Singapore, 1 Business Link, NUS Business School, Singapore, 117592, Singapore, bizcg@nus.edu.sg

Price, quality and advertising are three key strategic decisions firms need to make. In this paper we study the relationships and interactions among them by looking at a simple supply chain with one manufacturer and one retailer. Using a centralized supply chain as the benchmark case, we investigate the optimal decisions of the price, quality and advertising level in a decentralized supply chain.

5 - When and Why Retailers Sell Their Private Labels Through Competitors?

Liwen Chen, PhD Candidate, The University of Texas at Austin, Department of IROM, McCombs School of Business, Austin, TX, 78703, United States of America, liwen.chen@mail.utexas.edu, Steve Gilbert, Yunchuan Liu

We consider a supply chain consisting of a national brand manufacturer and two retailers who distribute the national brand to consumers. One of the retailers has the capability of selling her own private label. We study the strategic issues of when and why the retailer with private label capability sells the private label through the competitor.

■ MD53

H-Room 305, Third Floor

Mixed-Integer Programming with Chance Constraints

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Simge Kucukyavuz, Ohio State University, Columbus, OH, 43202, United States of America, kucukyavuz.2@osu.edu

1 - Probabilistic Set-covering with Correlations

Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, School of Industrial & Systems Engineeri, 765 Ferst Drive, Atlanta, GA, 30332, sahmed@isye.gatech.edu, Alper Atamturk, Dimitri Papageorgiou

We consider integer programming models for probabilistic set covering problems with correlated uncertainties. By exploiting the sub- and super-modularity properties of the probabilistic covering constraints and analyzing their polyhedral structure, we develop strong valid inequalities to strengthen the formulations.

2 - An Integer Programming Approach for Optimization with General Probabilistic Constraints

Jim Luedtke, University of Wisconsin-Madison, 3236 Mechanical Engineering, 1513 University Ave, Madison, WI, 53711, United States of America, jrluedt1@wisc.edu

We discuss how the integer programming approach which has been successfully applied for probabilistic constraints (also called chance constraints) with random right-hand side can be extended for general probabilistic constraints. Preliminary computational results will be presented.

3 - Disjunctive Normal Form Representation of Probabilistic Constraints

Miguel Lejeune, Assistant Professor, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

We present an approach to reformulate a probabilistic constraint as a Boolean function. We extend the Boolean function as a disjunctive normal form. We analyze its functional properties and use them to derive a solution method for probabilistically constrained optimization problems

■ MD54

H-Room 306A, Third Floor

Approximation and Online Algorithms

Sponsor: Optimization/Networks
Sponsored Session

Chair: Mohit Singh, Microsoft, One Microsoft Way, Redmond, WA, 98052, United States of America, mohsingh@microsoft.com

1 - Incentives in Online Auctions and Secretary Problems

Niv Buchbinder, Microsoft Research, 1 Memorial dr., Cambridge, MA, 02142, United States of America, nivbuchb@microsoft.com, Kamal Jain, Mohit Singh

Online auctions in which items are sold in an online fashion with little knowledge about future bids are common in the internet environment. We study a problem in which an auctioneer would like to sell an item. A bidder may make a bid at any time but expects an immediate decision. We study the issue of incentives in the online auction problem where bidders are allowed to change their arrival time if it benefits them. We show a LP based technique as a basic framework for analyzing the problem.

2 - Better Algorithms for Benign Bandits

Satyen Kale, Postdoctoral Researcher, Microsoft Research, 1 Memorial Drive, Cambridge, MA, 02138, United States of America, satyen.kale@gmail.com, Elad Hazan

We consider the non-stochastic bandit linear optimization problem, which is a repeated decision making problem where the set of decisions is a convex set in some Euclidean space, and the cost functions are linear. We propose a new algorithm for the bandit linear optimization problem which obtains a regret bound of O(sqrt{Q}), where Q is the total variation in the cost functions.

3 - A General Approach for Incremental Approximation and Hierarchical Clustering

Chandrashekar Nagarajan, Scientist, Yahoo! Inc, 2821 Mission College Blvd, 2GA-5226, Santa Clara, 95054, United States of America, chandra@orie.cornell.edu, Rajmohan Rajaraman, Guolong Lin, David Williamson

We present a general framework and algorithmic approach for incremental approximation algorithms. The framework handles cardinality constrained minimization problems, such as the k-median and k-MST problems. For these problems we either get new incremental algorithms, or improvements over what was previously known. We also show that the framework applies to hierarchical clustering problems. This gives an improved algorithm for a hierarchical version of the k-median problem introduced by Plaxton.

■ MD55

H-Room 306B, Third Floor

Supply Chain Risk Management and Multiple Sourcing

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

1 - Independence of Capacity Ordering and Financial Subsidies to Risky Suppliers

Volodymyr Babich, University of Michigan, 1205 Beal Avenue IOE 2783, Ann Arbir, MI, 48109, babich@umich.edu

We study joint capacity reservation and financial subsidy decisions of a manufacturer, dealing with a risky supplier whose financial state is described by a general firm-value model. General assumptions permitting the manufacturer to make ordering decisions independently from subsidy decisions are presented. Consequences of relaxing these assumptions are discussed. Conditions are presented for the optimal subsidy policy to have a subsidize-up-to structure.

2 - Safety Stock or Excess Capacity: Trade-offs under Supply Risk

Aadhaar Chaturvedi, IESE Business School, Avda. Pearson 21, Barcelona, 08034, Spain, achaturvedi@iese.edu, Victor Martinez de Albeniz

This paper investigates the trade-off between carrying high safety stock and planning for excess capacity, when a firm faces uncertain demand and supply. We use results from queueing theory to characterize a buyer's optimal strategy for the amount of capacity that it should contract from a supplier and the corresponding inventory that it needs to hold. Typically both are higher when demand or supply variability are higher. In addition, we apply our model to optimize multi-sourcing strategies.

3 - Sourcing Strategies for Short Life-Cycle Goods

Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Eduard Calvo

A buyer can source a product from different suppliers, each one having a different price and lead-time. A faster supplier provides the advantage of using a more accurate forecast, but this usually involves a higher cost. We characterize the optimal sourcing strategy under different scenarios such as single-sourcing and sequential multi-sourcing. In addition, we study the suppliers' competitive dynamics and find the prices that suppliers with different lead-times will quote in equilibrium.

■ MD56

H-Room 307, Third Floor

Optimization and Equilibrium Problems: Theory, Distributed Algorithms and Decomposition Schemes

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu

1 - Nash Equilibrium Problems with Congestion Costs and Shared Constraints

Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu, Huibing Yin, Prashant Mehta

We consider a noncooperative game in which agents face a congestion cost and contend with shared network constraints. Under a broad set of assumptions on the congestion costs (such as nonsmoothness), we provide existence results for the resulting generalized Nash equilibrium problem (GNEP). Uniqueness properties of related problems are also examined. Distributed dual and primal-dual schemes for computing the GNE are also presented.

2 - Asynchronous Gossip Algorithms for Stochastic Optimization

Angelia Nedich, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, United States of America, angelia@uiuc.edu, Sundhar Ram Srinivasan, Venu Veeravalli

We consider a distributed network system where the goal is to minimize the sum of functions, each of which is known with stochastic errors to a specific network agent. We propose an asynchronous algorithm based on a random gossip

scheme. We investigate the algorithm's convergence for differentiable nonconvex and convex nondifferentiable functions.

3 - Distributed Multiuser Optimization: Algorithms and Error Analysis
Jayash Koshal, Student, Industrial and Enterprise System Engineering, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, koshal1@illinois.edu, Angelia Nedich, Uday Shanbhag

We consider a multiuser problem of minimizing a sum of convex objective functions where user interactions are seen through either congestion cost functions or coupling constraints. We focus on distributed primal, primal-dual and dual schemes and analyze their convergence properties. We provide error bounds in regimes where a group of users terminate prematurely or when inexact primal solutions are obtained in the dual algorithm. Finally, we report some preliminary computational evidence.

4 - Second-Order Barrier Lagrangian Schemes For Stochastic Nonlinear Programming
Deanne Zhang, Paragon Decision Technology, 5400 Carillon Point, Kirkland, WA, 98033, United States of America, Deanne.Zhang@aimms.com, Uday Shanbhag

Lagrangian methods have proved successful for large-scale nonlinear programs. However, existing implementations can only provide convergence to first-order KKT points and the incapable with generalizations arising from addressing uncertainty. In this paper, we address precisely these two concerns, through the use of a barrier-Lagrangian method that employs Newton and negative curvature directions for computing second-order KKT points and decomposition schemes for stochastic nonlinear programs.

■ MD57

H-Room 308, Third Floor

OR in Public Health

Sponsor: Health Applications
Sponsored Session

Chair: Arielle Lasry, CDC, 1600 Clifton, Atlanta, United States of America, ftn9@cdc.gov

1 - Health Economic Assessment of Community Based CVD Risk Reduction Programs
Anke Richter, Associate Professor, DRMI / Naval Postgraduate School, 699 Dyer Rd, Bld 234, Monterey, CA, 93943, United States of America, arichter@nps.edu, Patricia Thieda

Austria runs community-based programs to reduce CVD risk factors. A health economic assessment was conducted using the QRISK2¬© model incorporated into an event-based simulation constructed in Excel. Costs are assessed from the perspective of the health ministry. Benefits include reduced numbers of cardiovascular events, reduced years of life spent in a diminished health state, and gains in life years. This tool compares different interventions to ensure that they provide good value for money.

2 - Calibrating the Effects of Knowledge of HIV Status in a Transmission Model Against Epidemiology Data
Stephen Sorensen, Mathematical Statistician, Centers for Disease Control, 1600 Clifton Road, M/S E48, Atlanta, GA, 30333, United States of America, zuc7@cdc.gov, Stephanie Sansom

Behavioral studies show that individuals aware of their HIV status engage in fewer risky behaviors, resulting in a significant reduction in HIV transmission. We built awareness of HIV serostatus into a dynamic, compartmental HIV transmission model of MSM in an urban setting. We explored the challenges of calibrating the model's estimates of infections to those observed in longitudinal epidemic surveillance data. We applied the model to an HIV screening program to increase awareness.

3 - Cost Efficiency of HIV Counseling and Testing Using Social Networks
Ram Shrestha, Economist, Centers for Disease Control and Prevention, 1600 Clifton Rd NE, MS E-48, Atlanta, GA, 30333, United States of America, biu0@cdc.gov, Stephanie Sansom

We used Data Envelopment Analysis (DEA) to evaluate the cost efficiency of a social network strategy, as delivered by 4 community-based organizations, to recruit clients for HIV counseling and testing and deliver new HIV diagnoses. We found that the least efficient two programs operated at about 70% of the cost efficiency of the most efficient two programs. We discuss the reasons behind the variation in cost efficiency, and the challenges of using DEA in HIV program delivery.

4 - Priority Setting for HIV Prevention Resources
Arielle Lasry, CDC, 1600 Clifton, Atlanta, United States of America, ftn9@cdc.gov, Stephanie Sansom, Katherine Hicks, Vladislav Uzunangelov

We model the allocation of HIV prevention funds in the US to over 90 combinations of populations and interventions. We use a non-linear optimization program that aims to select the funding amounts such that HIV incidence is minimized. The model may be used to help decision-makers understand the impact of trade-offs and deviations from the optimal funding scenario and evaluate the benefits of any additional funds. Results will be presented and discussed.

■ MD58

H-Room 309, Third Floor

Solving Response Time Variability Problems

Cluster: Scheduling
Invited Session

Chair: Jeffrey Herrmann, University of Maryland, Department of Mechanical Engineering, 2181 Martin Hall, College Park, MD, 20742, United States of America, jwh2@umd.edu

1 - The Response Time Variability Problem
Wieslaw Kubiak, Memorial University, Prince Philip Drive, St. John's, Canada, wkubiak@mun.ca

This talk introduces the Response Time Variability problem, its computational complexity, its main characteristics, and its applications.

2 - Using Hyper-heuristics for Solving the Response Time Variability Problem
Alberto Garcia-Villoria, Universitat Politecnica de Catalunya (UPC), Av. Diagonal, 647, Barcelona, 08028, Spain, alberto.garcia-villoria@upc.edu, Said Salhi, Albert Corominas, Rafael Pastor

Hyper-heuristics are a new methodology based on applying dinamically the right heuristic between a set of low level heuristics. We propose three constructive hyper-heuristics for solving a scheduling problem known as Response Time Variability Problem (RTVP). The RTVP arises whenever products or jobs need to be sequenced so as to minimise variability in the time between the instants at which they receive the resources. An experiment shows the effectiveness of the proposed hyper-heuristics.

3 - An Iterated Beam Search (IBS) Algorithm for the Response Time Variability Problem (RTVP)
Mesut Yavuz, Assistant Professor of QM & SCM, Shenandoah University, 1460 University Dr., Winchester, VA, 22601, United States of America, myavuz@su.edu

In this talk, we discuss two special cases of the RTVP, and an IBS algorithm developed for its solution. The two special cases are Single Sensor Scheduling (military ops.) and Scheduling of TV Commercials (service ops.). The TV Commercial Scheduling Problem is acyclic, i.e., it ignores the difference between the first and last execution times of a task in the planning horizon. We present our findings on this special case and discuss how IBS can be successfully adapted to solve the general RTVP.

4 - Scheduling Commercials on Broadcast Television
Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com, Marc Garbiras

Television networks sell advertising slots to clients by the shows on which the commercials air. They determine the exact location in the show that a commercial airs usually a few days before the airdate. There are several criteria the networks must meet in scheduling commercials. We developed and implemented an algorithm at the National Broadcasting Company to reduce sales personnel costs by automating the scheduling of commercials and to maximize customer satisfaction by minimizing errors.

5 - Using Aggregation to Reduce Response Time Variability
Jeffrey Herrmann, University of Maryland, Department of Mechanical Engineering, 2181 Martin Hall, College Park, MD, 20742, United States of America, jwh2@umd.edu

In order to generate high-quality solutions to the response time variability problem, we present an aggregation approach that combines products with the same demand, creates a sequence for the aggregated instance, and then disaggregates this solution into a feasible sequence for the original instance. Computational experiments show that using aggregation can reduce response time variability dramatically and also reduces computational effort.

■ MD59

H-Room 310, Third Floor

Tutorial: Cutting Plane, Cutting Surface, and Subgradient Methods

Cluster: Tutorials
Invited Session

Chair: John Mitchell, Professor, Rensselaer Polytechnic Institute, Department of Mathematical Sciences, 110 Eighth Street, Troy, NY, 12180, United States of America, mitchj@rpi.edu

1 - Cutting Plane, Cutting Surface, and Subgradient Methods
John Mitchell, Professor, Rensselaer Polytechnic Institute, Department of Mathematical Sciences, 110 Eighth Street, Troy, NY, 12180, United States of America, mitchj@rpi.edu

This talk provides an overview of four related topics. First, we discuss the incorporation of interior point methods into column generation, cutting plane, and decomposition approaches. Secondly, we describe the use of semidefinite relaxations to find exact solutions to combinatorial optimization problems. Thirdly, we consider cutting surface approaches to solving SDPs. Finally, we look at recent smoothing techniques for solving nonsmooth optimization problems using a subgradient approach.

■ MD60

H-Room 311, Third Floor

Geometric Aspects of Optimization

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Antoine Deza, McMaster University, 1280 Main West, Hamilton, Canada, deza@mcmaster.ca

1 - Counter Example to a Conjecture on the Homotopy Path for Infeasible Interior-point Methods
Kees Roos, TU Delft, Mekelweg 4, Delft, Netherlands, C.Roos@tudelft.nl, Guoyong Gu

In a recent paper a full-Newton step infeasible algorithm was presented with its worst-case iteration complexity. This bound depends linearly on a parameter of the homotopy path, which was shown to be less than the square root of 2n. Based on extensive computational evidence it was conjectured that the parameter equals 1, which would yield a better iteration bound then for all existing infeasible interior-point algorithms. We present an example showing that the conjecture is false.

2 - Shrink-wrapping Trajectories for Linear Programming
Yuriy Zinchenko, University of Calgary, yzinchen@ucalgary.ca

Hyperbolic Programming (HP) -minimizing linear objective over an affine subspace intersected with a hyperbolicity cone- is a class of convex optimization problems containing Linear Programming (LP) and its natural relaxations. Based on these relaxations a new Shrink-Wrapping approach for LP has been proposed by Renegar. We analyze Shrink-Wrapping trajectories near a certain invariant set containing LP optimum and contrast the trajectories with the central path on some pathological LP instances.

3 - On the Primal-Dual Geometry of Level Sets in Linear and Conic Optimization
Robert Freund, Professor, MIT, Sloan School of Mgmt., E52-476, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, rfreund@mit.edu

Motivated by the regularity conditions stemming from interior-point methods, we present a geometric relationship between the primal objective function level sets and the dual objective function level sets of conic optimization problems. The geometric relationship suggests a new way to conceptualize regularity and conditioning in conic convex optimization.

4 - Computational Approaches to the Hirsch Conjecture: D(4,12)=D(5,12)=D(6,13)=7
Antoine Deza, McMaster University, 1280 Main West, Hamilton, Canada, deza@mcmaster.ca, Lars Schewe, William Hua, David Bremner

Let D(d,n) be the maximum edge diameter of a polytope defined by n inequalities in dimension d. The conjecture of Hirsch, formulated in 1957, states that D(d,n) is not greater than n-d. The conjecture relates to the worst case performance of the simplex method. The best bound known for D(d,n) is quasi-polynomial [Kalai-Kleitman 1992]. Goodey [1972] showed that D(4,10)=5 and D(5,11)=6. Recently, Bremner and Schewe proved that D(4,11)=D(6,12)=6. We show that D(4,12)=D(5,12)=D(6,13)=7.

■ MD61

H-Room 312, Third Floor

Facility Location and Network Design Models

Sponsor: Location Analysis
Sponsored Session

Chair: Lian Qi, Rutgers, The State University of New Jersey, 1 Washington Park, Room 962, Newark, United States of America, lianqi@business.rutgers.edu

1 - Optimizing the DC Locations for a Multimodal-Shipping Network with Time Window Constraints
Gang Wang, Rutgers University, Department of SCM & Marketing Sci., Rutgers Business School, United States of America, gangwang@pegasus.rutgers.edu, Lei Lei

We study the location problem for distribution centers on a multimodal shipping network where each customer has a time window to receive the delivery and the objective is to minimize the operation cost. Special cases with polynomial time solutions are analyzed, and the empirical performance of a relaxation based search algorithm is reported.

2 - A Competitive Facility Location Game with Traffic Congestion Costs
Dincer Konur, Research Assistant, University of Florida, ISE Department 303 Weil Hall, Gainesville, FL, 32611, United States of America, dincer@ufl.edu, Joseph Geunes

We study a set of competitive firms considering the location of uncapacitated facilities at a set of locations in order to serve a set of markets. Each firm incurs linear transportation, convex congestion and fixed location costs. We consider an oligopolistic Cournot game and analyze the two-stage Nash Equilibrium. Algorithms are provided to determine the equilibrium quantities for the second stage of the game. An heuristic method is stated to determine the equilibrium location decisions.

3 - Natural Gas Network Capacity Expansion Optimization Models
Qipeng Zheng, PhD Student, University of Florida, Department ISE, Weil 303, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, zqp@ufl.edu, Panos Pardalos

In this talk, generalized network flow models are proposed to solve the natural gas network capacity expansion problems. These models are on the system level, where the whole system is considered and the objective is to minimize the total cost while satisfying the system demands by finding the locations of the pipelines. Also a multistage model is proposed to deal with the long term expansion problems, which can be solved by Embedded Benders' Decomposition proposed by the authors.

4 - The Hub Center Problem with Stochastic Travel Times
Edward Hult, Cambridge University, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, e.hult@jbs.cam.ac.uk, Daniel Ralph, Houyuan Jiang

For parcel delivery companies, it is important to guarantee clients a maximum parcel delivery time, which can be modeled by the stochastic p-hub center problem. We propose an integer linear programming formulation and develop computational approaches such as the Benders decomposition for finding exact solutions. We report computational results for standard medium-sized test examples.

■ MD62

H-Room 313, Third Floor

Differing Perspectives and a Critical Review of Behavioral Ops

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu

1 - The Interaction between Competitive and Cooperative Preferences in Social Dilemma Situations in Teams

Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg, Christoph Loch, Ghufran Ahmad

In a social dilemma, each participant optimally acts according to his individual interest, but as a result, everyone is worse off. However, not everyone behaves selfishly in teams because of social preferences: individuals care not only about their own welfare, but also about that of others (positively or negatively). We investigate in experimental studies the individual effects and interactions of two known social preferences, status seeking and relationship building.

2 - Fairness and Coordination Failures in Supply Chain Contracts

Valery Pavlov, Penn State University, University Park, PA, 16802, United States of America, vpavlov@psu.edu, Elena Katok

Evidence accumulated in the laboratory experiments with supply contracts suggests that preferences for fairness are one of the key behavioral factors affecting outcomes. We generalize some previous research on contracting in a bilateral monopoly by allowing both parties to experience disutility from unfair outcomes. In our experiment, we find that whereas fairness organizes the data very well there is virtually no support for bounded rationality hypothesis.

3 - Team Familiarity, Varied Experience, and Learning

Bradley Staats, Assistant Professor, University of North Carolina at Chapel Hill, McColl Building, Chapel Hill, NC, United States of America, bstaats@unc.edu, Francesca Gino, Gary Pisano

Work in the learning curve tradition examines how increasing cumulative experience yields improved performance. Experience, however, can take many forms. Building on recent studies on learning in operations, we distinguish between the repetition of tasks and the repetition of interactions (i.e., prior experience with other team members). Using an experimental study we find that prior experience with team members has a significant and persistent effect on learning.

4 - What Should Behavioral Operations Become?

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu

Behavioral Operations is experiencing a boom of interest now. How do we know it won't prove a fad, disappearing again after 5 years? I propose some important phenomena in the context of Operations, which can fuel a high impact and unique agenda for a community.

■ MD63

H-Room 314, Third Floor

Health Care Service Delivery Design

Contributed Session

Chair: Jagpreet Chhatwal, Health Economist, Merck Research Laboratories, North Wales, PA, 19454, United States of America, jagpreet_chhatwal@merck.com

1 - Optimization of Ambulance Move up

Lei (Oddo) Zhang, The Universiity of Auckland, 70 Symonds St, Auckland, New Zealand, lzha174@aucklanduni.ac.nz

A model for relocating a single vehicle to maximize the score of getting to the next call on time will be presented. A node labeling algorithm for solving large problems will be discussed. Then a relocation model which considers a single vehicle over an infinite horizon will be presented in which state space aggregation is used to deal with large problems. Finally, a heuristic relocation model for real ambulance operations will be presented along with simulation experiments.

2 - Clinical Trial Planning and Economic Evaluation in Drug Development Using Discrete Event Simulation

Jagpreet Chhatwal, Health Economist, Merck Research Laboratories, North Wales, PA, 19454, United States of America, jagpreet_chhatwal@merck.com, Erik Dasbach

The average cost to develop a drug exceeds $800 million; clinical trials consume nearly half the cost. Computer simulation can help with the planning and design of these clinical trials, improving the efficiency of the trial's design, increasing trial's success rate, and reducing overall trial costs. We present a discrete event simulation based model to simulate a phase III clinical trial and get useful information on what data may be feasible to collect for economic evaluations.

■ MD64

H-Room 202A, Second Floor

Undergraduate Research Showcase

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Blvd., Claremont, CA, 91711, United States of America, martonosi@hmc.edu

1 - The Optimal Tilt Angle of Solar Panels

Dylan Poulsen, University of Puget Sound, 2248 Wheelock Student Center, 1500 N Warner, Tacoma, WA, 98416-2248, United States of America, drspoulsen@gmail.com

If solar panels can be adjusted continuously, the optimal orientation aligns the face of the solar panel with the sun. Oftentimes, purchasing the equipment necessary for continuous adjustment is too expensive to justify the costs. Therefore less optimal adjustment schedules, such as seasonal adjustment, must be considered. In this talk we derive a model for the energy a solar panel receives daily at variable tilt angles. We then examine the costs and benefits of various adjustment schedules.

2 - On Determining the Number of Class Requests

Catie Patterson, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, catie.patterson1151@furman.edu

First-year seminars are designed to help incoming freshmen adjust to college-level material and work load. At Furman, students are asked to indicate at least five choices for seminars in which they have some interest. Here we look at the problem of determining how many choices to give students so as to ensure, with high probability, that a given percentage of students will be scheduled to a preferred class.

3 - Rethinking the Encounter Probability for Commercial Aviation Direct to Target Attacks

Garrett Howe, Virginia Commonwealth University, Nuclear Engineering, Richmond, VA, 23284, United States of America, howegl@vcu.edu, Laura McLay, Rebecca Dreiding

A nuclear attack is considered one of the most pressing terrorist threats. Our nation is particularly vulnerable to 'direct to target' terrorist attacks, which would occur before border security screening takes place. The so-called encounter probability has been proposed for evaluating border security screening operations. We propose alternative performance measures that cover flights and targets, and we analyze these performance measures using multiobjective integer programming models.

4 - Dynamic Modeling of Resource Requirements for Non-Acute Patient Care: Cornell Dynamic FMS Simulator

Michelle Castorena, Cornell University, 103 Highland Place, Apt 2, Ithaca, NY, 14850, United States of America, mc457@cornell.edu

When an emergency arises of certain types, a Federal Medical Station (FMS) is set up to assist affected locales in treating non-acute care patients. The purpose of this talk is to describe how consumable and reusable resource requirements can be estimated for a FMS throughout the duration of a campaign. We will discuss a simulation environment created to estimate these resource requirements.

5 - Disrupting Terrorist Networks

Lee Wiyninger, Harvey Mudd College, dwiyninger@hmc.edu, David Zitter, Susan E Martonosi

What makes certain types of social networks more vulnerable to communication flow disruption? In this talk, we will define a metric for measuring communication flow disruption. We will then examine how the structural properties of different classes of social networks determine the vulnerability of such networks to communication disruption when the network is modified.

■ MD75

C-Room 32A, Upper Level

Train Scheduling

Sponsor: Railroad Applications
Sponsored Session

Chair: Krishna Jha, Innovative Scheduling Systems, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States of America, krishna@innovativescheduling.com

1 - A Multi-stage, Hybrid Model for Train Schedule Optimization

Clark Cheng, Sr. Manager Operations Research, Norfolk Southern Corp., 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, Clark.Cheng@nscorp.com, Jian Liu, Edward Lin

This paper presents a multi-stage, hybrid model to optimize train routes and operating schedules at Norfolk Southern. The model is composed of a set of modules and algorithms that determine train routes, block-to-train assignments, crew assignments, locomotive balancing, and train schedules. We have used the model to develop train service plans for network design and yard rationalization studies.

2 - Implementing A Comprehensive Train Planning Model Results

Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com, Dharma Acharya, Krishna Jha

Determining a railroad's train plan is a very complex and large-scale planning problem as it involves all of its resources: railcars, crews, locomotives, yards, and tracks. We have recently performed a study of optimizing a railroad's train plan. In this presentation, we will describe what we did and how we did it. We will also share the lessons learnt in this process - what works and what does not work in practice.

3 - A Genetic Algorithm Procedure to Solve the Railway Routing and Scheduling Problem

Pavankumar Murali, University of Southern California, University Park, Los Angeles, CA, 90089, United States of America pmurali@usc.edu, Maged Dessouky, Fernando Ordonez

We present an integer programming approach to dispatch trains on routes that minimize delays. The quality of the routes and departure times from origin stations obtained by this approach are compared with the delays from a simulation model that uses a construction heuristic to dispatch trains [Lu et al. (ACM Transactions, 2004)]. We also present a genetic algorithm-based solution approach to obtain arrival and departure times at intermediate stations and to break ties during meets and overtakes.

Tuesday, 8:00am - 9:30am

■ TA01

C-Room 21, Upper Level

Portfolio Decision Analysis I

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu

1 - Decision Analysis for Corporate Portfolio Strategy
Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

Portfolio applications come in many forms. In this session we will will examine the many dimensions of portfolio problems and then review a case study of a corporate business portfolio strategy. This portfolio strategy resulted in nearly doubling shareholder value and restructuring of the corporate enterprise.

2 - Challenges to Porfolio Decision Analysis in Organizations
David Matheson, SmartOrg, 855 Oak Grove Avenue, Suite 202, Menlo Park, CA 94025, United States of America dmatheson@smartorg.com, Jim Matheson

Portfolio management methodology far exceeds companies' ability to use it, and intervention-based consulting can limit lasting impact. The key is embedding good portfolio practices in the organization. Issues like raising the bar on critical thinking about economic issues, obtaining credible & comparable evaluations, tracking and learning are crucial. Dealing with the contradictions between good practices for project management and for portfolio management are especially challenging.

3 - ERA: A Framework and Interactive Scheme for Elicitation in Resource Allocation Decisions
Alec Morton, Lecturer in Operational Research, London School of Economics, Houghton St, London, WC2A2AE, United Kingdom, A.Morton@lse.ac.uk, Jose Figueira

We present a framework for thinking about Elicitation in Resource Allocation decisions, based on a constructive view of preference formation. We show how this framework can be the basis of a computationally practical interactive scheme and demonstrate this scheme with examples drawn from practice.

4 - Portfolio Decision Analysis of DOE's R&D on Energy Efficiency and Renewable Energy
Max Henrion, CEO, Lumina Decision Systems, Inc, 26010 Highland Way, Los Gatos, CA, 95033, United States of America, henrion@lumina.com, James Milford, Sam Baldwin, Walter Short, Surya Swamy

The US Department of Energy funds R&D in a wide range of energy efficiency and renewable energy technologies. The SEDS (Stochastic Energy Deployment System) model evaluates possible portfolios in terms of their effects on energy costs, GHG emissions, and oil imports. It is based on model of the entire US energy economy to 2050. It projects the market adoption of each technology based on expert elicitations of its performance and costs based on R&D funding levels.

■ TA02

C-Room 22, Upper Level

Value of Information

Sponsor: Decision Analysis
Sponsored Session

Chair: J. Eric Bickel, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

1 - The Value of Perfect Information as a Risk Measure
Philippe Delquie, INSEAD, Boulevard de Constance, Fontainebleau, France, philippe.delquie@insead.edu

The Value of Information measures the value that can be gained from resolving the uncertainty, i.e., removing the risk, in a gamble. Flipping it around, it may provide a good Measure of Risk.

2 - Value of Information in the Stochastic 0-1 Knapsack Problem
Kun Zan, PhD Student, The University of Texas at Austin, OR/IE, 1 University Station Stop C2200, Austin, TX, 78712, United States of America, kzan@mail.utexas.edu, J. Eric Bickel

Value of information (VOI) is one of the most important and interesting applications of decision analysis. Yet, despite much research, few general properties of VOI have been proved. Intuitive properties such as the value of information increasing as uncertainty is increased have been shown not to hold in general. In this paper, we consider VOI within the context of the stochastic 0-1 knapsack problem. We show that within this setting, some interesting and sometimes intuitive properties do hold.

3 - Relative Value of Information
J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

We investigate the value of imperfect information relative to perfect information (RVOI). Within the context of a two-action decision problem with normal priors and exponential utility, we derive a closed-form solution for the RVOI. These results deepen our understanding of information value and enable practitioners to estimate the value of imperfect information in particular settings.

4 - Impact of Risk Aversion and Value of Information in Lotteries
Onur Bakir, Postdoctoral Research Associate, University of Southern California, 3710 McClintock Ave, RTH 322, Los Angeles, 90034, United States of America, nbakir@usc.edu, Georgia-Ann Klutke

This study analyzes the information acquisition problem in a lottery setting. Information is evaluated using the buying price approach. We investigate the role of the decision maker's risk tolerance in valuing information bundles. In particular, we derive conditions under which there exists a monotonic relationship between the decision maker's risk tolerance and the value of information for generic information bundles. We illustrate our results with examples as well.

■ TA03

C-Room 23A, Upper Level

Integrated Methodologies for MCDA

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Theodor Stewart, Emeritus Professor of Statistical Sciences, University of Cape Town, Building 28 (P D Hahn), Room 307, Rondebosch, 7701, South Africa, Theodor.Stewart@uct.ac.za

1 - New Developments of the PROMETHEE & GAIA MCDA Methods
Bertrand Mareschal, Professor, Université Libre de Bruxelles, Boulevard du Triomphe CP 210-01, Bruxelles, 1050, Belgium, bmaresc@ulb.ac.be, Yves De Smet

We introduce developments of the PROMETHEE & GAIA MCDA methods. PROMETHEE provides rankings of a set of alternatives according to several decision criteria. New visual representations of the rankings are proposed and the elicitation of preference parameters is also considered. GAIA is a descriptive complement to PROMETHEE. New variants are proposed to give a better vision of the decision problem, to improve the link with the PROMETHEE rankings and to enhance the quality of the decision process.

2 - The D-SIGHT Project: The Next Generation of Promethee-Gaia Software
Yves De Smet, Professor, Université Libre de Bruxelles, Boulevard du Triomphe CP 210-01, Bruxelles, 1050, Belgium, yves.de.smet@ulb.ac.be, Bertrand Mareschal, Quantin Hayez

PROMETHEE and GAIA belong to the family of outranking methods. They provide both prescriptive and descriptive tools for multicriteria decision aid problems. This talk is a short tutorial of the new software based on this methodology. Key features such as new visual representations and sensitivity analysis tools will be illustrated. Among them special attention will be paid to new Gaia developments, to the "decision maker brain" function and to partial ranking investigations.

3 - Integrating DEA and Goal Programming for Performance Benchmarking
Theodor Stewart, Emeritus Professor of Statistical Sciences, University of Cape Town, Building 28 (P D Hahn), Room 307, Rondebosch, 7701, South Africa, Theodor.Stewart@uct.ac.za

We extend standard data envelopment analysis (DEA) to include longer term top management goals. The new model uses a goal programming structure to find points on the efficient frontier which are realistically achievable by DMUs, but at the same time achieving a closer approach to the long term organizational goals. Constraints on the DMU may be adjusted by investment in extended inputs or new technologies, giving investment cost as an additional management objective.

■ TA04

C-Room 23B, Upper Level

Joint Session ICS/DM Optimization in Data Mining/Machine Learning

Sponsor: Computing Society & Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu

1 - Solving the Sparse PCA SDP Relaxation
David Phillips, Assistant Professor, College of William & Mary, Math Department, Williamsburg, VA, 23185, United States of America, djphil@wm.edu, Garud Iyengar, Cliff Stein

In this presentation, we present an algorithm to solve the Sparse PCA SDP relaxation. Our solution algorithm solves a Lagrangian saddle point problem via a prox method of Nesterov's. Some key differences in our approach from previous algorithms is our use of a quadratic prox function and that we return feasible solutions to the SDP relaxation, where the former leads to a better run theoretical bound. Experimental results are presented.

2 - Relaxing Support Vectors with Linear and Quadratic Programming Models
Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, seref@vt.edu

In this talk, we introduce linear and quadratic programming models to relax vectors that are usually misclassified by maximal margin classifiers using a restricted amount of free (unpenalized) total slack. We introduce kernelized versions and emphasize important properties of these models. We also introduce a simple 2-phase method based on these models for multiple instance classification and present competitive computational results on public benchmark datasets and neurological data.

3 - From Pictures to 3D: A Global Optimization Approach
Manmohan Chandraker, University of California, San Diego, La Jolla, United States of America, mkchandraker@cs.ucsd.edu, David Kriegman, Sameer Agarwal, Serge Belongie

We present practical algorithms for achieving globally optimal solutions for 3D scene reconstruction from 2D images. We pose the non-convex problem as a fractional program and construct efficient convex envelopes to perform minimization in a branch and bound paradigm. A unified framework is developed for minimizing the standard L2-norm as well as the robust L1-norm. We demonstrate that exploiting domain knowledge can alleviate branch and bound's worst case exponential complexity in practice.

4 - Locally Linear Support Vector Machines
Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu, Vojislav Kecman

In this talk we present a new method for combining the k-nearest neighbors (KNN) and support vector machines (SVM) to produce a classifier that reflects local patterns in data. The Locally Linear SVM (LLSVM) is able to maximize margin and minimize error in the input feature space for points in the neighborhood of a query and derive globally complex separating surfaces. Theoretical evidence of the superior stability of LLSVM over global (traditional) SVM is given.

■ TA05

C-Room 23C, Upper Level

Operations and Management in Energy Industry I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Eunshin Byon, Texas A&M Universtiy, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@neo.tamu.edu

1 - Subproblem Approximation in Dantzig-Wolfe Decomposition of Energy Market Equilibrium Models
David Fuller, UWaterloo, 200 University Ave, Waterloo, Canada, dfuller@engmail.uwaterloo.ca, William Chung

The talk outlines the extension of Dantzig-Wolfe decomposition from pure optimization problems to variational inequality (VI) problems. Several ways to approximate the subproblem can produce better proposals, while retaining the theoretical convergence properties. Illustrations are given for a model of Canadian energy markets.

2 - Welfare and Incentive Effects of Energy Storage
Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

We examine the welfare effects of energy storage use and contrast the incentives of storage use amongst different agent types.

3 - Optimal Maintenance Strategies for Wind Turbine Systems Under Stochastic Weather Conditions
Eunshin Byon, PhD candidate, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@tamu.edu, Yu Ding, Lewis Ntaimo

We examine optimal repair strategies for wind turbines. Based on the information from sensors installed at turbines, our research objective is to derive an optimal maintenance policy that minimizes the expected average cost over an infinite horizon. We formulate the problem as a partially observed Markov decision process. Several critical factors, unique to wind farm operations, are considered. We derive a set of closed-form expressions for the optimal policy.

■ TA06

C-Room 24A, Upper Level

IEEE Transactions on Automation Science & Engineering Sponsored Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: N. Viswanadham, Assistant Professor, Clinical Professor, Indian School of Business, Hyderabad-500032, India, N_Viswanadham@isb.edu

Co-Chair: Yu Ding, Associate Professor, Texas A&M University, 3131 MS, College Station, TX, 77843, United States of America, yuding@iemail.tamu.edu

1 - Port-of-Entry Inspection: Sensor Deployment Policy Optimization
Elsayed Elsayed, Professor, Rutgers University, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu, Minge Xie, Yada Zhu, Hao Zhang, Christina Young

At the port-of-entry containers are inspected through a sequence of stations to detect illegal cargo. The inspection policy, which includes the sequence in which sensors are applied and the threshold levels used at the inspection stations, affects the probability of misclassifying a container as well as the cost and time spent in inspection. We will present our work in the optimization of such inspection systems, as well as recent investigation to reduce the effect of measurement error.

2 - Sensor Selection in Arbitrary Dimensions
Malik Magdon-Ismail, Associate Professor, Rensselaer Polytechnic Institute, magdon@cs.rpi.edu, Volkan Isler

We address the sensor selection problem which arises in tracking and localization applications. In sensor selection, the goal is to select a small number of sensors whose measurements provide a good estimate of a target's state. We focus on the bounded uncertainty sensing model where the target is a point in the d dimensional Euclidean space, and show that, on the plane, four sensors are sufficient to obtain an estimate whose area is at most twice the area of the best possible estimate.

3 - Identification of Influential Process Variables for Surface Quality Control in Hot Rolling
Shiyu Zhou, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706-1572, United States of America, szhou@engr.wisc.edu, Nong Jin, Tzyy-Shuh Chang, Howard Huang

Surface defects have been a long-term troubling issue in hot rolling processes. In this paper, functional data analysis and rigorous statistical testing are integrated to identify the process variables that significantly influence the surface quality of the finished products. The results can provide guidelines for root cause identification and surface quality improvement in hot rolling processes.

■ TA07

C-Room 24B, Upper Level

Quality Control for Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Tirthankar Dasgupta, Harvard University, Science Center, Dept of Statistics, 1, Oxford St, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu

1 - Statistical Models for Hot Electron Degradation in Nano-Scaled MOSFET Devices

Paul Kvam, Professor, Georgia Tech, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States of America, paul.kvam@isye.gatech.edu, Suk Joo Bae

In a MOS structure, the generation of hot carrier interface states is a critical feature of the device's reliability. On the nano-scale, there are problems with degradation in transconductance, shift in threshold voltage, and decrease in drain current capability. Quantum mechanics has been used to relate this decrease to degradation and device failure. We model the distribution of hot-electron activation energies, which exhibits two-point discrete mixture of logistic distributions.

2 - Profiling Nanoparticles

Chiwoo Park, Researcher, Texas A&M University, 241 Zachry Engineering Research Center, Texas A&M University, 3131 TAMU, College Station, TX, 77843-3131, United States of America, chiwoo.park@gmail.com, Yu Ding

Nanoparticles have many potential applications because of their unique and interesting properties shown in nanoscale. The properties are highly correlated with the size and the shape of nanoparticles, which is well known as "quantum confinement effect". For this reason, measuring and controlling the size and the shape is an important work in the development of new nanomaterials. Our research is on an autonomous procedure for measuring the size and the shape of nanoparticles processed.

3 - Weight Kinetics Modeling for Silica Nanowires Growth Catalysed by Pt Thin Film

Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu, Tirthankar Dasgupta, Yu An, Li Zhu

The nanostructure weight kinetics during growth is of interest. We first postulated the weight kinetics model based on an initial run of experiment and physical knowledge. A nonlinear piece-wise model was fitted with smooth transition between segments. Model comparison was conducted as well.

4 - A D-optimal Design for a Generalized Exponential Model Governing Growth of Nanowires

Tirthankar Dasgupta, Harvard University, Science Center, Dept of Statistics, 1, Oxford St, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu, Qiang Huang, Li Zhu

A locally D-optimal design for estimation of parameters of a complex curve characterizing nanowire growth that is partially exponential and partially linear is obtained using a geometric approach. A sequential algorithm is proposed for obtaining the D-optimal design. The convergence of the sequential algorithm to the D-optimal design is demonstrated using Monte-Carlo simulations.

5 - A Systematic Methodology for Robust Optimization of Nano-manufacturing Processes

Jye-Chyi Lu, Professor, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, 30332-0205, United States of America, jclu@isye.gatech.edu, Martha Grover, Justin Vastola

A Bayesian model for a batch nanoparticle synthesis process is upgraded to a stochastic-mechanistic simulation tool. Simulation data are used to build a statistical-mechanistic model of lower complexity. Physical data are then collected based on optimal experimental design plans to validate and improve the statistical-mechanistic model. Finally, the refined model is used for process optimization.

■ TA08

C-Room 24C, Upper Level

Pervasive Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Hui Xiong, Association Professor, Rutgers University, MSIS Department, 111 Washington Street, Newark, NJ, United States of America, hxiong@rutgers.edu

Co-Chair: Alexander Tuzhilin, New York University, atuzhili@stern.nyu.edu

1 - Collaborative Information Acquisition

Maytal Saar-Tsechansky, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, TX, 10012, United States of America, Maytal.Saar-Tsechansky@mccombs.utexas.edu

Prior work on information acquisition to improve predictive modeling focuses on learning a single model. However, given an acquisition budget, it is important to understand how we can enable predictive modeling techniques to collaboratively reason about information acquisitions so as to improve complex decisions. In this talk I will discuss this new problem, our approach to address it, and relevant applications.

2 - A Study of Quality and Accuracy Tradeoffs in Process Mining

Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, PA, 16802, United States of America, zanhuang@psu.edu, Akhil Kumar

In this talk we share our key insights from a study of mining process models from noisy real and synthetic logs. We propose self-loop and optional structures for the block-structured process model to deal with noisy log instances. By controlling the use of self-loop and optional structures around tasks and blocks of tasks we can balance the quality and accuracy tradeoff to derive high-quality process models that explains a given percentage of instances in the log.

3 - Optimization of Spatio-Temporal Clustering for Target Tracking From Multi-Sensor Data

Zhe Liang, Rutgers University, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu, W. Art Chaovalitwongse, Andrew Rodriguez

This study focuses on how to fuse both accurate and inaccurate information broadcasted from wide area search munitions (WASMs) and reconstruct the battle space for accurate target tracking. We propose a network model to represent all the feasible movement of the targets. An integer linear problem formulation is used to find the most probable target tracks. Our approach provided better results than the k-means clustering method for all the real world test cases.

4 - Direction Clustering for Characterizing Movement Patterns

Hui Xiong, Association Professor, Rutgers University, MSIS Department, 111 Washington Street, Newark, NJ, United States of America, hxiong@rutgers.edu, Wenjun Zhou, Yong Ge

In this talk, we introduce a direction-based clustering (DEN) method which aims to group trajectories with similar directions into the same clusters. Specifically, we partition the space into grids and introduce a probabilistic model to turn direction information in a grid into a vector with eight values to indicate the probabilities of moving towards eight directions within the grid. With this data transformation, we develop the DEN method and exploit it for understanding the user behaviors.

■ TA09

C-Room 25A, Upper Level

Applications of Queueing Theory

Sponsor: Applied Probability
Sponsored Session

Chair: Tolga Tezcan, Asst Prof, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, ttezcan@uiuc.edu

1 - Disitribution-Valued Heavy-Traffic Limits for the Processor Sharing Queue

Josh Reed, New York University, Stern Business School, 44 West Fourth Street, New York, NY, 10012, United States of America jreed@stern.nyu.edu

We study the GI/GI/1 processor sharing queue where the total capacity may vary depending upon the number of customers in the system. We first obtain a semi-martingale decomposition of the process keeping track of how much service each customer has received. Using this decomposition we then obtain fluid and diffusion limits. A criteria which depends on the capacity function is obtained for the diffusion limit to be stable. Steady-state distributions are also derived.

2 - Efficient Communication of Poisson Process with Applications in Flow Linking in Networks

Negar Kiyavash, Assistant Professor, University of Illinois at Urbana-Champaign, 128 CSL, 1308 W. Main, Urbana, IL, 61801, United States of America, kiyavash@illinois.edu

Linking network flows using flow timings is a crucial problem in intrusion detection and anonymity. This requires efficient communication of the timings to the decoder, classically done by first compressing and then transmitting the flow using a channel code. Due to delay and complexity requirements, it is desirable to bypass these steps. We drive sufficient conditions for optimal uncoded transmission of a Poisson flow with identity encoder and decoder mappings with zero-rate side information.

3 - Managing Service Systems with an Offline Waiting Option and Customer Abandonment

Vasiliki Kostami, University of Southern California, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, kostami@usc.edu, Amy Ward

We study a model that resembles the FASTPASS system in Disneyland, in which customers have the choice of waiting in a line or going offline; i.e., leaving and returning at a future time. We solve for the optimal capacity allocation, and estimate the in line and offline wait times. The estimation of offline wait times is complicated by the fact that some customers may not return for service.

4 - Robust Design of IVR Systems in Call Centers

Tolga Tezcan, Asst Prof, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, ttezcan@uiuc.edu, Banafsheh Behzad

We consider a call center system with a single customer class and a single server pool. Upon arrival, customers first use an interactive-voice-recognition (IVR) system before being transferred to an agent if necessary. We consider the design of the IVR system under demand rate uncertainty. Using fluid model approximations, we show how effective design of the IVR can improve service quality and decrease costs in a call center.

■ TA10

C-Room 25B, Upper Level

Joint Session APS/Inventory Management: Analysis of Stochastic Inventory System

Sponsor: Applied Probability & Inventory Management
Sponsored Session

Chair: Xiuli Chao, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, xchao@umich.edu

1 - Upgrading Policies During the Exploitation Phase for an Improved Component of a Capital Good

Kurtulus Baris Öner, PhD Student, Eindhoven University of Technology, Technische Universiteit Eindhoven, Postbus 513, Eindhoven, 5600 MB, Netherlands, K.B.Oner@tue.nl, Geert-Jan van Houtum, Gudrun Kiesmuller

We consider an OEM who is responsible for the availability of sold systems in the field. After the reliability improvement of one of the components of the system the OEM has to decide what policy to follow for upgrading the systems. We compare two basic policies: 1. Replace all components at once and 2. Replace a component when it fails. We determine the optimal costs for both policies and identify the situations where policy one is outperforming policy two.

2 - The Joint Pricing-procurement Control of a Make-to-Order Firm under Fluctuating Raw Material Prices

Yifeng Liu, New Jersey Institute of Technology, 323 Martin Luther King Jr Blvd, Newark, NJ, 07102, United States of America, yl222@njit.edu, Jian Yang

We consider a make-to-order firm that converts raw-material units into finished products. The raw material process is Markovian, while the order-arrival process is time-independent and yet elastic. We show the optimality of base-stock-list-price type of policies with the additional raw-price dependency. More importantly, we identify sufficient conditions on the raw-price process and the end-demand elasticity, under which policy parameters change in intuitive patterns when raw price changes.

3 - Integrated Planning of Spare Parts and Service Tools

Ingrid Vliegen, Technische Universiteit Eindhoven, Den Dolech 2, Paviljoen E15, Eindhoven, 5461BD, Netherlands I.M.H.Vliegen@tue.nl, Geert-Jan van Houtum

To perform a maintenance action, spare parts, service tools and service engineers need to be available. In this talk, we focus on the planning problem for a combination of tools and parts, based on an actual problem of an OEM in the semiconductor supplier industry. We consider a multi-location, multi-item inventory model, in which demands occur for sets of parts and tools. Our objective is to minimize the investment costs subject to meeting the service level agreed upon with customers.

■ TA11

C-Room 25C, Upper Level

Service Operations

Cluster: Queueing Models
Invited Session

Chair: Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu

1 - Irrationality in Queues

Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Achal Bassamboo, Tingliang Huang

In this talk, we consider a queuing system with a single server and homogeneous customer. Customer upon arrival observe the state of the system and make the decision whether to join the system or not. Based on Naor's model we know that if the customers are perfectly rational, then the social surplus is lower than the first best. We investigate how the system performance changes with customer's irrationality.

2 - Responding to Unexpected Overloads in Large-Scale Service Systems

Ohad Perry, Columbia University, New York, NY, United States of America, op2105@columbia.edu, Ward Whitt

We consider how two large-scale service systems that operate independently can help each other when one encounters an overload, involving a jump in the arrival rate. We propose a queue-ratio control, which activates sharing of customers by the service pools when a threshold is exceeded. This control requires no knowledge of the arrival rates. Our analysis is based on a fluid model, which includes a heavy-traffic averaging principle.

3 - Reserving Capacity for Urgent Patients in Primary Care

Sameer Hasija, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Sameer.Hasija@insead.edu, Gregory Dobson, Edieal Pinker

We examine the effect of reserving slots for urgent patients in a primary health care practice on two service quality measures: the average number of urgent patients that are not handled during normal hours and the average queue of routine patients. We present a stochastic "dam" model of appointment scheduling. We find that, for certain cases, performance may improve if no slots are reserved, i.e., patients are scheduled according to a rule similar to the Advanced-Access system.

4 - Appointment-driven Queueing Systems with Non-punctual Customers

Saif Benjaafar, Professor, University of Minnesota, Industrial and Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu, Oualid Jouini

Motivated by applications in healthcare, we study a queueing system where customer (patient) arrivals are driven by scheduled appointments. However, patients can be non-punctual and may arrive before or after their scheduled appointments or may even not show up. We allow for non-punctuality to be described by general distributions that may be patient-specific.

■ TA12

C-Room 26A, Upper Level

Computation Models of Air Transportation Management

Sponsor: Computing Society
Sponsored Session

Chair: Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, SEOR Dept, 4400 University Drive, Fairfax, VA, 22030, United States of America, khoffman@gmu.edu

1 - The Impact of Fuel Prices and Slot Controls on Airline Operations

John Ferguson, George Mason University, Mail Stop 4A6, Center for Air Transport, Fairfax, VA, 22030, United States of America, jfergus3@gmu.edu, Karla Hoffman, Lance Sherry, Abdul Qadar Kara

Airline behavior is driven by a combination of economic, network and political factors. Recent fluctuations in fuel prices and the addition of slot controls for Newark Liberty and New York John F. Kennedy airports provide a unique opportunity to examine these effects. This paper presents a model to examine airline behavior in the presence of slot controls and fuel price fluctuations and the impacts of these behaviors on the air transportation system.

2 - Gate-Waiting-Delay Causes and Mitigations at Major US Airports
Jianfeng Wang, George Mason University, 4450 Rivanna Ln # 3727, Fairfax, VA, 22030-4441, United States of America, jwang5@gmu.edu, John Shortle

Airport gates are one of the congestion points of the air transportation system. When an arriving flight lands on a runway, it is possible that it cannot pull into its gate due to gate unavailability. We define this phenomenon as gate-waiting delay. This paper investigates the functional origins of gate-waiting delays at several major US airports and discusses corresponding mitigation strategies.

3 - A Congestion Pricing Model to Handle "Day of Operations" - Airport Capacity Reductions
Abdul Qadar Kara, George Mason University, Mail Stop 4A6, Center for Air Transport, 4400 University Drive, Fairfax, VA, 22030, United States of America, akara@gmu.edu, Karla Hoffman, John Ferguson

We present congestion pricing models for use as a demand management tool for dealing with reductions in airport capacity due to inclement weather. These prices are based on both the congestion cost that flights impose on other flights needing the same resources and on the profitability of each flight. We present results for LaGuardia airport.

■ TA13

C-Room 26B, Upper Level

Optimization and Complex Stochastic Systems

Sponsor: Computing Society
Sponsored Session

Chair: Christine Shoemaker, Ripley Professor, Cornell University, 210 Hollister Hall, Ithaca, 14850, United States of America, cas12@cornell.edu

1 - Stochastic Control of Continuous-Time and Continuous-State Systems via Direct Comparison
Xiren Cao, Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, eecao@ust.edu.hk

The standard approach to stochastic control is dynamic programming. We introduce an alternative approach based on direct comparison of the performance of any two policies, by modeling the state process as a continuous-time and continuous state Markov process. The approach provides a unified framework for stochastic control and other optimization theory and methodologies. The new insights obtained may lead to new research topics.

2 - Knowledge Gradients With Monte Carlo Simulation In Online Learning Problems
Ilya Ryzhov, Princeton University, Princeton, NJ, 08540, United States of America, iryzhov@princeton.edu, Warren Powell

Suppose we have a set of alternatives whose true values are unknown, but can be estimated through expensive field tests. We allow correlations, so one test may provide information about multiple alternatives. If the number of alternatives is large, we propose a learning policy which uses Monte Carlo sampling to reduce the choice set to a small number of promising alternatives, and then applies a one-period look-ahead approach using knowledge gradients to choose among this reduced set.

3 - The Correlated Knowledge Gradient for Continuous Decision Variables
Warren Scott, Graduate Student, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, wscott@princeton.edu, Warren Powell, Peter Frazier

We extend the concept of the Correlated Knowledge-Gradient Policy for ranking and selection to the case of continuous decision variables. We propose an Approximate Knowledge Gradient, along with an algorithm to maximize it, which is applicable to a problem with a large set of feasible decisions. In the problem class considered, we use the Approximate Knowledge-Gradient to sequential choose where to sample an expensive noisy function in order to find the maximum quickly.

■ TA14

C-Room 27A, Upper Level

Optimization in Practice III - Logistics

Sponsor: Computing Society
Sponsored Session

Chair: Erica Klampfl, Ford Research & Advanced Eng., 2101 Village Rd., Dearborn, MI, 48124, United States of America, eklampfl@ford.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Multi-Depot, Multi-Destination, Mix-fleet School Bus Routing Problem
Sam Thangiah, Professor, Slippery Rock University, 250 ATS, Slippery Rock, PA, 16057, United States of America, sam.thangiah@sru.edu, Joseph Forsythe, Daniel Bly, Nethkelum Perera

We present a school bus routing system implemented to solve a real-life multi-depot, multi-destination, mix-fleet vehicle routing problem for a school district. The school district consisted of 1200 pickup points, 2000 students and 60 school buses. The precise distances between the pickup points were obtained using digitized road maps. The solutions obtained by the implemented system are compared with the routes in use by the school district.

2 - Depot-Level Capacity Model Requirements System (DLCMRS)
Donna Middleton, Operations Research Analyst, Northrop Grumman, 12900 Federal Systems Park Drive, FP1/3122P, Fairfax, VA, 22033, United States of America, Donna.Middleton@ngc.com, John Chalecky

Northrop Grumman has developed a linear programming model to assist the Marine Corps Logistics Command in calculating optimal depot-level maintenance capacity, and DoD 4151.18H factors. The model has the capability to provide a recommended configuration of the depot to optimally or near optimally achieve a given capacity, and to determine the impact of a specific change or set of changes on the current capacity.

3 - PuD Optimization in DHL International Americas
Felipe Villegas Moran, Head of Programms and Engineering, DHL Express IA, 110 N federal Hwy Appt 1103, Fort Lauderdale, United States of America, felipe.villegas@dhl.com

There is a substantial body of knowledge to apply when optimizing Pick Up and Delivery Operations. However in practice, companies are not always ready to profit from it. Often we find challenges in explaining solutions in business terms as well as limitations on systems, data, training and people. In this talk we discuss real world examples from an existent engineering that struggled to introduce OR into daily practice, translating complex models into simple tools.

4 - Intelligent Refueling Advisory System
Erica Klampfl, Ford Research & Advanced Eng., 2101 Village Rd., Dearborn, MI, 48124, United States of America, eklampfl@ford.com, Kacie Theisen, Oleg Gusikhin, Yimin Liu

With wild fluctuations in gas prices, services providing gasoline information are becoming increasingly popular. We present an advisory system that helps drivers minimize fuel costs through a mobile app/web interface: an underlying MIP uses vehicle information, gas prices, driver preferences, and a forecasting algorithm to provide future or missing gas prices.

■ TA15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - AnyLogic North America
Andrei Borschev, CEO and Managing Director, AnyLogic North America, 9 Ramsey Road, Lebanon, NJ, 08833, United States of America, andrei@xjtek.com

AnyLogic is the first and only simulation tool that supports system dynamics, process-centric (discrete event) and agent-based methods within one modeling language and one model development environment. We will demo several AnyLogic models and show how the user can benefit from using different modeling methods, and from agent-based modeling in particular.

2 - Salford Systems - Introduction to Data Mining for Absolute Beginners

Mikhail Golovnya, Senior Scientist, Salford Systems, 4740 Murphy Canyon Road, #200, San Diego, CA, 92108, United States of America, golomi@salford-systems.com

This is a perfect place to start if you are new to data mining, even if you have little-to-no background in statistics. We will discuss: (1) data basics: data types, formats, and preparation steps; (2) what kinds of questions we can answer with data mining; (3) how data mining models work; (4) evaluation criteria—how models can be assessed and their value measured; and (5) specific background knowledge to prepare you to begin a data mining project.

■ TA16

C-Room 28A, Upper Level

Online Communities and Consumer Behavior in eCommerce Research

Sponsor: Information Systems
Sponsored Session

Chair: Jesse Bockstedt, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22201, United States of America, jesse.bockstedt@gmail.com

1 - Moderated Online Communities and User-Generated Content

Jianqing Chen, University of Calgary, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, jiachen@ucalgary.ca, Hong Xu, Andrew Whinston

To induce quality content for online communities, we introduce moderation into reputation systems. We show that under moderation commentators may display a pattern of reputation oscillation—they generate useful content to build up high reputation and then exploit it. The expected performance from high reputations can thus be inferior to that from low reputations. We then discuss the optimal moderation resource allocation, and conclude that reputation oscillation may arise as an optimal result.

2 - Fall From Grace: Understanding Knowledge Retention in Online Collectives

Gerald Kane, Assistant Professor, Carroll School of Management, Boston College, 140 Commonwealth Ave, Chestnut Hill, MA, 02467, United States of America, gerald.kane@bc.edu, Sam Ransbotham

Little research has explored whether and how these collectives retain knowledge ñ a critical process in organizational knowledge management. Using the complete history data of 2065 Featured Articles on Wikipedia articles over a 7-year history, we analyze how collaborative processes help collectives retain knowledge and how processes associated with effective knowledge retention differ from those associated with knowledge creation.

3 - The Role of the Internet in Customized Products Supply Chains

Cheryl Druehl, Assistant Professor, George Mason University, School of Management, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu, Jesse Bockstedt

Over the past few decades, the mass customization movement has grown, pushed by steady advances in back-end strategies for producing custom products. However, true customization requires significant interaction with a consumer to capture specifications. The Internet provides the last technological link for developing an efficient customized products supply chain. We discuss strategies for customer-designed custom products, focusing on the additional costs/benefits for the customer and the firm.

■ TA17

C-Room 28B, Upper Level

Social Interactions in Business: Models and Processes

Sponsor: e-Business
Sponsored Session

Chair: Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

1 - Noncompetes and Brain Drains

Lee Fleming, Professor, Harvard Business School, United States of America, lfleming@hbs.edu, Matt Marx

We demonstrate that states that enforce noncompetes have lost inventors to states which do not. We provide historical data since 1975 and the results of a natural experiment from an inadvertent shift in noncompete enforcement in Michigan. We also demonstrate that it is inventors with the greatest human and social capital that are most likely to leave. Social capital is a stronger predictor, based on a measure of connectedness into the largest national component.

2 - Good, Bad, or Ugly? An Empirical Investigation of Feedback-Revoking Behavior on EBAY

Siva Viswanathan, Associate Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Shun Ye, Gordon Gao

This study investigates the selective revoking of negative feedback by sellers on eBay. Taking advantage of the recent changes in eBay's reputation system and the resulting strike, we find that sellers opportunistically revoke negative feedbacks under the old two-way system. However, denied the opportunity to retaliate against buyers under the new system, we find that these sellers improve the quality of their transactions and feedback scores.

3 - Impact of Recommender Systems on Volume and Diversity of Purchases

Kartik Hosanagar, Professor, The Wharton School, United States of America, kartikh@wharton.upenn.edu

We evaluate the impact of recommender systems on the volume and diversity of products consumers purchase online. A widely held view is that recommenders will fragment consumers, i.e. cause consumers to have less in common with one another. Our empirical study shows that users actually become more similar to one another in terms of their purchases. This similarity is because consumers change what they buy and also because they simply purchase more.

4 - Censoring, Interdependence and Scalability for Dyadic Social Media Data

Michael Braun, Assistant Professor of Management Science and Homer A. Burnell Career Development Professor, Massachusetts Institute of Technology, One Amherst St., E40-169, Cambridge, MA, 02139, United States of America, braunm@mit.edu, Andre Bonfrer

When analyzing social media data, we typically do not observe the full network, but without considering unobserved events, we get poor inferences and predictions. For a dataset of N individuals, there are N(N-1)/2 dyads to consider, so standard methods are generally intractable. Our nonparametric Bayesian method exploits the discreteness of the Dirichlet process to dramatically reduce the computational burden encountered when estimating models on networked data.

■ TA18

C-Room 28C, Upper Level

Network Design in Telecommunications

Sponsor: Telecommunications
Sponsored Session

Chair: Stefan Voss, Professor, University of Hamburg, IWI - Institute of Information Systems, Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@hamburg.de

1 - A Node Rooted Flow-based Model for the Local Access Network Expansion Problem

Luis Gouveia, Associate Professor of the Department of Statistics and Operations Research, Faculty of Sciences, at the University of Lisbon, Portugal, legouveia@fc.ul.pt, Margarida Goncalves

In the LANEP we need to expand a given tree network by increasing the capacity of the edges or by installing concentrating devices in some nodes of the network, in order to satisfy the increase in node demands. In this talk we present a new flow-based model that permits us to solve in an easier way, instances from the literature. We test and compare the new and old models for instances with 100, 200 and 500 nodes in order to show the advantages of the new proposed model.

2 - Lagrangian Approach for Bounded-Degree Spanning Tree Problem

Monica Gentili, Dr, University of Salerno, Via Ponte Don Melillo, Fisciano, SA, 84084, Italy, mgentili@unisa.it, Raffaele Cerulli, Francesco Carrabs, Manlio Gaudioso

We describe a variant of the spanning tree problem where we seek a spanning tree with the minimum number of branch vertices (that is vertices of the tree whose degree is greater than two). We study the Lagrangian relaxation of this problem and approach the solution of the Lagrangian dual by means of a finite ascent algorithm. We provide numerical results on some benchmark problems together with comparison with a standard subgradient procedure.

3 - Soliving the Minimum-cost Ring-cover Problem via Branch-and-Cut

Eli Olinick, Associate Professor, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, olinick@engr.smu.edu

The minimum-cost ring-cover problem is an important and difficult optimization problem arising in the design of reliable, high-speed telecommunications networks. We present an integer-programming formulation for this problem and an empirical analysis of a branch-and-price procedure for solving it.

4 - The Generalized Regenerator Location Problem
Si Chen, Assistant Professor, Murray State University, Murray, KY, 42071, United States of America, si.chen@murraystate.edu, Ivana Ljubic, S. Raghavan

In the generalized regenerator location problem (GRLP) we are given a set of candidate locations for regenerators (S), and a set of nodes that must communicate with each other (T). We wish to deploy as few regenerators as possible, while ensuring that all the nodes in T can communicate. We show that the GRLP is NP-Complete. We model the GRLP as a Steiner forest problem and provide computational results of two heuristics and the MIP formulation.

■ TA19

C-Room 28D, Upper Level

Routing Behavior and Traffic Assignment

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Laurie Garrow, Georgia Tech, 790 Atlantic Dr, Atlanta, 30332, United States of America, Laurie.Garrow@ce.gatech.edu

1 - Practical Implications of Finding Consistent Route Flows
David Boyce, Adjunct Professor, Northwestern University, 633 Clark Street, Evanston, IL, 60208, d-boyce@northwestern.edu, Hillel Bar-Gera, Marco Nie

Practical analyses of results from the static traffic assignment model are often based on route flows, even though route flows are not uniquely determined by the user equilibrium assumption. We compare route flow results aggregated to select link analysis from several solutions. An additional assumption of proportionality is suggested as a way to choose one route flow solution in a consistent and stable manner. We show the performance of different solutions in terms of proportionality.

2 - Stochastic Transportation Networks with Routing Inertia and Scenario Preference: Theoretical Basis and Modeling Method
Zugang Liu, Assistant Professor of Business Administration, Pennsylvania State University - Hazleton, 76 University Dr, Hazleton, PA, 18202, United States of America, zxl23@psu.edu, Chi Xie

Stochastic transportation networks with routing inertia and scenario preference: Theoretical basis and modeling method Abstract: A mixed-equilibrium traffic assignment problem for stochastic transportation networks with routing inertia and scenario preference is formulated, solved and numerically analyzed. The modeling method offers a new paradigm of describing day-to-day traffic dynamics due to network supply and demand variations and analyzing the network performance evolution from feeding traffic information to the driving population.

3 - How Far is Traffic From User Equilibrium? An Empirical Test of Wardrop's First Principle
Xiaozheng He, University of Minnesota, hexxx069@umn.edu, Shanjiang Zhu, Henry Liu, David Levinson

Wardrop's widely accepted first principle of User Equilibrium (UE) concept has not been validated with real data. This study tests the UE by using surveys and GPS data collected from Twin Cities Metropolitan area. Temporal and spatial measures are provided to capture the gap between the ideal UE condition and the observed conditions. The measures will further researchers and practitioners' understanding in developing and applying traffic assignment models based on UE.

4 - Non Monotonicity of Path Travel Time In Dynamic Traffic Assignment: Implications
H. Babai, Northwestern University, Evanston IL 60208, hamedalibabai2011@u.northwestern.edu, Hani Mahmassani

Existence of an interior equilibrium solution to dynamic assignment problems and convergence to such a solution has been predicated on the assumption of the monotonicity of the path travel time function. This paper shows that most realistic representations of traffic dynamics in a traffic assignment model are likely to result in violations of the monotonicity assumption.

■ TA20

C-Room 28E, Upper Level

Fleet Redistribution

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu

1 - Optimization in Operations of Alternative Fuel-Powered Fleets
Sevgi Erdogan, Research Assistant, University of Maryland, 1173 Glenn L.Martin Hall, Civil and Environmental Eng.Dept, College Park, MD, 20742, United States of America, serdogan@umd.edu, Elise Miller-Hooks

As businesses and agencies transition to fleets that rely on alternative fuels and vehicle technologies in an effort to reduce their contribution to global warming, numerous operational problems have arisen. In this presentation, one such problem, the alternative fuel-powered fleet operations problem, is formulated. Solution algorithms are proposed for its solution and results are evaluated on a test problem.

2 - Tractor Fleet Sizing and Repositioning Strategies
Jose Antonio Carbajal, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, acarbajal@gatech.edu, Alan Erera, Martin Savelsbergh

Trucking companies operating consolidation networks can attain cost savings by using tractor repositioning strategies. We investigate models to determine the value of executing repositioning moves (in addition to the ones required to balance resources throughout the network) as a means to reduce the system-wide costs associated with owning and operating a tractor fleet during a planning horizon. Several repositioning strategies are studied and computational results are shown for test instances.

3 - Fleet Redistribution for Vehicle Sharing Operations
Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu, Elise Miller-Hooks

A shared vehicle system involves a fleet of vehicles located across a network, from which users are free to checkout vehicles and return them to a station close to their destination. When demand is highly directional, fleet inventories at certain stations may be inadequate leading to rejected demand. A chance-constrained program is proposed that determines a least-cost redistribution plan such that most demand is satisfied.

■ TA21

C-Room 30B, Upper Level

Methods and Models for Road Pricing II

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Siriphong Lawphonganich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611-6595, United States of America, lawphong@ise.ufl.edu

Co-Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu

1 - Optimal Road Pricing In a Stochastic Dynamic Environment
Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Jing Dong

A Stochastic Dynamic Programming (SDP) technique is adopted to determine optimal road prices for real-time traffic management. The objective is to minimize the total travel time, while assuming each traveler chooses the least cost route. By incorporating field observations in the SDP, real-time road pricing schemes have the potential to account for nonrecurrent congestion, within-day dynamics, and instantaneous user response.

2 - A Computable Theory of Dynamic Congestion Pricing
Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, Dept of Industrial & Systems Engineering, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu, Terry Friesz, Taeil Kim, Tao Yao

We report on a theory of dynamic congestion pricing. The equilibrium design problem takes the form of an MPEC, which we call the Dynamic Optimal Toll Problem with Equilibrium Constraints, or DOTPEC. The DOPTEC maintains the usual design objective of minimizing the system travel cost by appropriate toll pricing. We describe how an infinite dimensional mathematical programming perspective may be employed to create an algorithm for the DOTPEC.

3 - On the Complexity of the Minimum Tollbooth Problem
Lihui Bai, Valparaiso University, 1909 Chapel Drive, Valparaiso, United States of America, Lihui.Bai@valpo.edu, Donald Hearn, Siriphong Lawphonganich

We study the complexity of a first best toll pricing problem that minimizes the number of toll booths (MINTB) required and simultaneously causes the tolled equilibrium to reproduce the system optimal flows. A reduction from the minimum cardinality multi-way cut problem shows that MINTB is NP-hard. Some variations of the NP-hardness results are also discussed.

4 - Properties and Design of Build-Operate-Transfer Scheme in General Networks
Di Wu, University of Florida, 518C Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, wudi@ufl.edu, Yafeng Yin, Siriphong Lawphonganich

This paper examines the properties of the equilibrium state in general networks with multiple private toll roads under a build-operate-transfer (BOT) scheme. Competing with others, private road operators decide capacities and tolls of the roads to maximize their own revenue. To ensure the public interest, a mathematical model is formulated for government agencies to select best BOT projects from a pool of candidates to maximize the social welfare.

■ TA22

C-Room 30C, Upper Level

Warehouse Operations I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - Analytical Models for Automated Storage and Retrieval Systems and Autonomous Vehicle Storage and Retrieval Systems
Sunderesh Heragu, University of Louisville, Department of Industrial Engineering, Louisville, KY, 40292, United States of America, s.heragu@louisville.edu, Cai Xiao, Ananth Krishnamurthy, Charles Malmborg

This paper presents semi-open queuing network based models for performance evaluation of Automated Storage and Retrieval Systems and Autonomous Vehicle Storage and Retrieval Systems. The models are validated against simulation and are used to provide design insights that could be used to determine the technology choice in different application scenarios.

2 - Does Class-Based Storage Really Reduce Travel Time?
Yugang Yu, Assistant Professor, Rotterdam School of Management, Erasmus University, T10-38,Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, yyugang@rsm.nl, Rene De Koster

Class-based storage is widely claimed to reduce travel time in a warehouse as compared to random storage. We study class-based storage allowing a storage space per product larger than its average inventory level. We develop a model and optimize the number and boundaries of classes to minimize the travel time to store or retrieve products. Examples show a larger number of classes may give a longer travel time.

3 - Stochastic Models of Warehousing using Systems
Manjunath Kamath, Professor, Oklahoma State University, School of Industrial Engr. & Mgmt., 322 Engineering North, Stillwater, OK, 74078, United States of America, mkamath@okstate.edu, Karthik Ayodhiramanujan

We develop analytical models for evaluating the performance of warehousing systems using a building block approach. We focus on two key building blocks, namely, a shared-server system, in which S/R servers store and retrieve items from a finite capacity rack and a queueing-inventory model that can handle changes in unit-load configurations (e.g., pallets and cases). We illustrate our modeling approach using an example warehouse system with forward and reserve storage areas.

4 - Integrated Analysis of Order Picking and Sorting Operations in a Rectangular Warehouse
Rakesh Nagi, Professor and Chair, University at Buffalo (SUNY), 438 Bell Hall, Buffalo, NY, 14260, United States of America, nagi@buffalo.edu, Melih Temel, Rajan Batta

We propose a new model that integrates order picking and sorting via an automated sorting system. We study different batching, zoning and sorting policies for the coordinated and efficient operations. We estimate the combined time spent on order picking and sorting for a batch of orders with greater accuracy and provide managerial insights on the above decision.

■ TA23

C-Room 30D, Upper Level

Defense Supply Chain Issues

Sponsor: Military Applications Society
Sponsored Session

Chair: Alan Johnson, Associate Professor, 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 - The Need for Accountability in the Military Information Supply Chain
Michael Grimaila, Air Force Institute of Technology, AFIT/ENV, Wright-Patterson AFB, OH, 45433-7765, United States of America, michael.grimaila@afit.edu, Evan Anderson, Joobin Choobineh, Robert Mills

Virtually all organizations embed information technologies into their core processes as a means to increase operational efficiency. Since the accuracy, conciseness, and timeliness of information can dramatically impact operations; the recognition and documentation of information dependencies is essential to gain a true appreciation of its operational risk. In this presentation, we discuss the need for accountability in the military information supply chain to assure the mission operations.

2 - Using Analysis to Support In-Theater Management of Contractor Logistics Support Contracts
Norman Reitter, Operations Research Director, Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15905, United States of America, reittern@ctc.com

Effective in-theater monitoring of logistics support contracts has been an issue in OIF and OEF for the past five years. This presentation will discuss how an integrated quality management approach supported by analysis is being used to manage logistics support contracts in a theater of operations to achieve improved efficiency and effectiveness while promoting partnering between stakeholders, the organization, and contractors.

3 - An Optimization of the Hub-and-spoke Distribution Network in United States European Command
Stephan Brady, Assistant Professor of Operations and Supply Chain Management, Penn State Harrisburg, E-355 Olmsted Building, 777 West Harrisburg Pike, Middletown, PA, 17057, United States of America, stephan.brady@psu.edu, Ben Skipper, William Cunningham

This research utilizes a Multiple Objective Linear Programming (MOLP) model to analyze hub locations in USEUCOM to determine the trade-offs between time and cost. The threat of multiple contingencies against unknown aggressors requires an efficient and effective network of locations for reception/forward movement of material. This network must be flexible enough to handle peacetime operations and to support unknown contingency, peacekeeping, or humanitarian efforts.

4 - Launch Vehicle Logistics Response Time Investigation
Alan Johnson, Associate Professor, 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, Carlos Molina, August Roesener

We investigate the effects and interactions of potential ground support and vehicle design factors for a proposed reusable military space launch vehicle, to identify a preferred design strategy that can minimize resource requirements necessary to achieve logistics response time goals. Our research uses an existing Arena discrete-event simulation in combination with JMP's Design of Experiment Enabler to screen approximately 50 candidate factors.

■ TA24

C-Room 30E, Upper Level

Newsvendor Economics

Cluster: Economic Models in Operations Management
Invited Session

Chair: Nicholas Petruzzi, University of Illinois, 350 Wohlers Hall, 1206 S. 6th St., Champaign, IL, 61820, United States of America, petruzzi@illinois.edu

1 - Newsvendors, Agents and Alignment
Anupam Agrawal, University of Illinois at Urbana-Champaign, Champaign, IL, 61820, anupam@illinois.edu, Nicholas Petruzzi

We have two objectives in this paper. First, we review the literature in the Principal-Agent theory from Economics, Finance and Operations to understand the current state-of-the-art, and the extant insights. Second, we analyze how uncertainty and risk affect contracting between principals, between agents, and between principals and agents. This is work in progress, and our main objective is to get feedback for further research.

2 - Public Policy Implications of the Newsvendor Model
Gal Raz, University of Virginia, Charlottesville, VA, 22903, razg@darden.virginia.edu, Yigal Gerchak

The supplying of a produced good is a game that includes three players, the firm supplying the good, the consumers that are buying it and the government that can intervene in the transaction by imposing rules and regulations. In this paper, we study a supply chain that sells a product to end consumers in a newsvendor setting, taking a social planner perspective and examining the possible government actions and their implications.

3 - Ordering, Pricing, and Leadtime Quotation under Demand and Leadtime Uncertainty
Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, bkazaz@syr.edu, Scott Webster, Zhengping Wu, Kum-Khiong Yang

We study the price-setting newsvendor problem in the presence of uncertain delivery lead-time. The demand for the product depends not only on the selling price, but also on the quoted lead-time. The firm has to carefully balance the holding cost and tardiness cost incurred from early and late completion of the product from the quoted lead-time. The paper determines the optimal selling price, quoted lead-time, and the inventory level simultaneously under demand and lead-time uncertainty.

■ TA25

C-Room 31A, Upper Level

Airport Operations II

Sponsor: Aviation Applications
Sponsored Session

Chair: Gautam Gupta, Associate Research Scientist, University Affliliated Research Center, Building 210, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States of America, gautam.gupta@nasa.gov

1 - Applying Regression and Queuing Model to Predict Taxi Times at Airports for Emission Reduction
Yu Zhang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, yuzhang@eng.usf.edu

How to reduce taxiing delay and consequent extra fuel burn and emissions has attracted enormous attentions from aviation community. This study propose a combination of regression and queuing models with an iterative algorithm to analyze the components of taxi times and predict taxi times. The performance of the model is validated through a comparison of its predictions with observed data at various airports.

2 - Integrated Taxiing and Take-Off Scheduling with Reordering at Runway Holding Points at Airport
Jacob Tsao, College of Engineering/San Jose State University, One Washington Sqaure, San Jose, CA, 95192-0085, United States of America, Jacob.Tsao@sjsu.edu, Wenbin Wei, Agus Pratama

We consider airports whose runway entrances are equipped with a holding point where any aircraft already having entered the holding point can take off ahead of any other aircraft still held at the holding point, and hence consider explicitly the feature of reordering aircraft at the entrance for more efficient take-off. We report integrated formulations as mixed-integer mathematical programming problems and our numerical experiences.

3 - A Review of Three Decades of Airport Runway Optimization
Mohammad Mesgarpour, PhD Student, University of Southampton, School of Mathematics, Highfield, Southampton, SO17 1BJ, United Kingdom, m.mesgarpour@soton.ac.uk, Julia A. Bennell, Chris N. Potts

The techniques and tools of Operational Research have been used to investigate, model, and optimize aircraft landing and takeoff as the principal bottlenecks of the air traffic control and airport system. The challenge lies in putting theory in practice which can simultaneously handle the safety, efficiency, robustness, competitiveness, and green environment. This paper addresses the airport runway optimization problem over the last three decades and also identifies the key future research.

4 - Value of Stochastic Runway Scheduling
Senay Solak, Assistant Professor, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@som.umass.edu, Ellis Johnson, Gustaf Solveling, John-Paul Clarke

Although runway operations contain significant uncertainty, stochastic scheduling models have not been considered for these problems. This is due to the assumption that the variances are low when decisions are made within short planning periods, and that such stochastic models are complex. We first present a novel, computationally efficient stochastic runway scheduling algorithm, and then discuss findings on the value of stochastic runway scheduling based on the two issues described above.

■ TA26

C-Room 31B, Upper Level

Edelman Finalists Reprise - II

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

1 - Norske Skog Improves Global Profitability Using OR
Kjetil Vatn, Norske Skog, Box 329, Lysaker, 1326, Norway, Kjetil.Vatn@norskeskog.com, Andy B. Philpott, Graeme Everett, Rune Gjessing

For paper maker Norske Skog uncertain demand and recession is a familiar situation, there has been a declining demand for years. Use of OR started in New Zealand as a regional supply chain model, later becoming a global model. In a recent case PIVOT was in downsizing the company. The MIP model was used to study a series of scenarios, giving confidence that the decision was optimal. Potential savings is about $120 million/year USD, equivalent to 3 % of annual turnover.

2 - Marriott International Increases Revenue by Implementing a Group Pricing Optimizer
Sharon Hormby, Senior Director, Marriott International, 10400 Fernwood Rd, Bethesda, MD, 20817, United States of America, Sharon.Hormby@marriott.com, Julia Morrison, Tim Tenca, Prashant Dave, Michele Meyers

Marriott International's Group Pricing Optimizer, a decision support system, provides guidance to hotel personnel in pricing hotel rooms for group customers. The system employs demand segmentation, price elasticity modeling and optimization techniques to recommend an optimal rate. In operation since late 2006, the system has improved profitability for hotels and enhanced the sales process for both sales managers and customers.

■ TA27

C-Room 31C, Upper Level

Simulation in Health Care II

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Rafael Diaz, Research Assistant Professor, Old Dominion University / VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, RDiaz@odu.edu

1 - A System Dynamic Approach to Modeling the Sensitivity of Inappropriate Emergency Department Utilization
Joshua Behr, Associate Research Scientist, Virginia Modeling, Analysis and Simulation Center, 1030 University Blvd., Suffolk, United States of America, jbehr@odu.edu

This research identifies the drivers manifest in the individual decision calculus to seek non-emergent services from the Emergency Department. We use System Dynamic (SD) M&S to measure the sensitivity of the two, often-competing, values of congestion and profitability and, thus, provide an additional layer of information designed to inform strategic decision making. We are able to identify the impact of alternate interventions among subpopulation vis-a-vis congestion and profitability.

2 - An Application of Simulation-based Optimization in ED's Resource Allocation

Rafael Diaz, Research Assistant Professor, Old Dominion University / VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, RDiaz@odu.edu, Peter Foytik

Successful efforts have been made in the development of simulations and optimizations that address health care management issues. Some authors have used simulation optimization to combine the virtues of both techniques, and thus, solve complex allocation problems. In our research, we investigate the effects of scheduling and illustrate the application of simulation-based optimization in an Emergency Department.

3 - Demand Forecasting for Real Options Valuation in Healthcare

Yun Shin Lee, PhD Candidate, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Stefan Scholtes

Real options in healthcare systems in rapidly changing demand circumstances are of value. We study simulation-based demand forecasting models for valuing such real options. Our first forecasting model is constructed from stochastic diffusion processes which are conventionally used in real options valuation. We propose an alternative demand forecasting model: adaptive trend fitting with stochastic forecast errors. We compare the two forecasting models using Monte Carlo Simulations.

4 - Effects of RFID Topology and Failure on Patient Flow and Health Care Quality

Mohammed Ferdjallah, Old Dominion University, United States of America, mferdjal@odu.edu, Joshua Behr

Advances in information processing and electronic medical recording have led to remarkable improvements in heath care management. Radio frequency identification devices (RFID) are currently used to enhance patient flow and resources management. As RFID technology becomes integrated in the management, the efficiency and failure would negatively impact the outcome of health care. We used a simulation model to investigate the effects of using RFID on patient flow in an emergency department.

■ TA28

H-Room 500, Fifth Floor

Cooperation and Competition in Networks

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Parijat Dube, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10598, United States of America, pdube@us.ibm.com

Co-Chair: Rahul JainAssistant Professor, University of Southern California, Department of Electrical Engg. - Systems, EEB 328, 3740 McClintock Avenue, Los Angeles, CA, 90089, United States of America, rahul.jain@usc.edu

1 - Real-time Wireless Spectrum Markets

Randall Berry, Associate Professor of EECs, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, rberry@eecs.northwestern.edu

There is an increasing awareness that current policies for allocating wireless spectrum are inefficient. One approach to remedying this is via "real-time" spectrum markets. A challenge in implementing such markets is accounting for the interference among different users of spectrum. We describe models for such a market which leverage different communication paradigms for managing interference and study the efficiency of the resulting market mechanisms.

2 - Architecting Efficient, Stable, and Fair Random Access Networks: A Conjectural Equilibrium Approach

Yi Su, University of California Los Angeles (UCLA), 54-147A Engineering IV Building, 420 Westwood Plaza, Los Angeles, CA, 90095, United States of America, yisu@ee.ucla.edu, Mihaela van der Schaar

For wireless LANs, such as IEEE 802.11 networks, the channel utilization efficiency, the system stability, and the fairness of bandwidth allocation are three important issues when designing their medium access control (MAC) protocols. This paper aims to design a simple access mechanism optimized for all the aforementioned issues from a game theoretic perspective using a conjectural equilibrium approach.

3 - Congestion Games and Their Application to Spectrum Sharing

Mingyan Liu, Associate Professor of EECS, University of Michigan, EECS Department, 1301 Beal Avenue, Ann Arbor, MI, 48109, United States of America, mingyan@eecs.umich.edu, Yunnan Wu, Sahand Ahmad

Recent advances in software defined radio give wireless devices the ability to dynamically access spectrum. This talk presents decentralized spectrum sharing mechanisms using a congestion game framework. While with some very appealing features, the standard congestion game does not capture pair-wise interference in wireless communication. We address this using two approaches, the first through a re-definition of resources and the second through an extension to the congestion game.

4 - Equilibrium and Efficiency in Multi-class Queueing Games

Rahul Jain, Assistant Professor, University of Southern California, Department of Electrical Engg. - Systems, EEB 328, 3740 McClintock Avenue, Los Angeles, CA, 90089, United States of America, rahul.jain@usc.edu, Parijat Dube

We develop a framework to study differentiated services when there are competing network providers. We model the relationship between capacity, QoS and prices offered by service providers in a competitive network services market. We establish sufficient conditions for existence of Nash equilibrium in the multi-class queueing game. We also explore characterization of inefficiency in the multi-class queueing game model.

■ TA29

H-Room 501, Fifth Floor

Simulation Models in Energy Markets

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Augusto Micola, Assistant Professor, Universitat Pompeu Fabra, Ramon Triaas Fargas 25, Barcelona, Spain, augusto.ruperezmicola@gmail.com

1 - Simulating Wholesale Electricity Markets: The Devil is in the Details

Albert Banal-Estanol, Assistant Professor, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, Barcelona, 08005, Spain, A.Banal-Estanol@city.ac.uk, Augusto Micola

This paper uses an agent-based model of wholesale electricity markets to explore issues of model validity and consistency. We address the issues of software standardisation and theoretical validation. We study several supply and demand specifications and propose an algorithm based on the "experience weighted attraction modelwhich encompasses the existing behavioural algorithms of the literature.

2 - Agent-based Modeling of Supply Function Equilibria in Electricity

Steven Kimbrough, Professor, University of Pennsylvania, Wharton Business School, Philadelphia, PA, United States of America, kimbrough@wharton.upenn.edu, Fred Murphy

Supply function equilibrium models have few usable theoretical properties for understanding electricity markets. In this paper we add more realism to a supply-curve equilibrium model using an agent-based model. We examine two aspects that are missing. First, we look at the effect of fixed costs in bidding in the day-ahead market. Second, we introduce forward markets and examine what the agents do.

3 - Design and Implementation of a Multifunction, Multimarket Simulator

Gerald Sheblé, Professor, University of Porto/INESC, Rua Dr. Roberto Frias, 378, Campus da FEUP, Porto, 4200 - 465, Portugal, gsheble@inescporto.pt, Vladimiro Miranda

This paper presents a market simulator design that is flexible to support maintenance scheduling in a regulated environment and multi-market simulation in a competitive market. The first is a multiple market simulation of an ISO including Energy, Load Following, Frequency Following, and Reserve, as well as environmental (CO2) market. This is a competitive environment including renewable resources and electric vehicles. The algorithms and results implemented will be included.

4 - Learning and Cost Shocks Adaptation in Energy Markets

Stephane Tchung-Ming, Researcher, IFP, 258 avenue Napoleon Bonaparte, Rueil-Malmaison, 92852, France, Stephane.tchung-ming@ifp.fr, Olivier Massol

We use a learning algorithm to study how agents adapt to cost shocks. An application is proposed to analyse the indexation structure of natural gas contracts in a stylised baseload electricity market.

■ TA30

H-Room 502, Fifth Floor

Open Pit Mine Planning, I

Sponsor: Energy, Natural Res & the Environment/ Mining
Sponsored Session

Chair: Marcos Goycoolea, Universidad Adolfo Ibañez, Diagonal Las Torres 2640, Peñalolén, Santiago, Chile, mgoycool@gmail.com

1 - Strategic Mine Planning: A New Scalable Approach to Optimal Block Scheduling

Eduardo Moreno, Universidad Adolfo Ibañez, Avda. Diagonal Las Torres 2640, Santiago, Chile, eduardo.moreno@gmail.com, Daniel Espinoza, Marcos Goycoolea

A critical aspect of long-term open-pit mine planning consists in designing a block extraction schedule.This problem can be modeled with integer-programming, but the size of typical block models makes intractable to standard solvers. In this talk we present a scalable integer-programming based methodology for solving very large (millions of blocks) instances of this problem. Using these techniques we are able to obtain near-optimal solutions to large problems in a few hours.

2 - Open Pit Block Sequencing Using Valid Cuts and Lagrangian Relaxation

Brian Lambert, Colorado School of Mines, United States of America, wlambert@mines.edu, Alexandra Newman

An open pit mine optimizes profits by maximizing the net present value of the extracted orebody. An exact method to determine the block extraction sequence is formulating the problem as a mixed integer program with a time-indexed binary variable for each block representing if and when the block is extracted. We utilize valid cuts and Lagrangian relaxation to reduce solution times, providing numerical results obtained from data sets of tens of thousands of blocks and up to 15 time periods.

3 - Network Optimization and Open Pit Mining

Kadri Dagdelen, Professor, Colorado School of Mines, Mining Engineering Department, 1600 Illinois Street, Golden, CO, 80401, United States of America, kdagdele@mines.edu

Abstract not available at this time.

■ TA31

H-Room 503, Fifth Floor

Pricing and Revenue Management: Beyond Revenue

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Darius Walczak, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dwalczak@prospricing.com

1 - Salesforce Incentives in Revenue Management

Ayse Kocabiyikoglu, Bilkent University, Faculty of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr, Ioana Popescu

We investigate a revenue management setting where capacity allocation decisions are delegated to an agent, incentivized on salary plus commission. We compare the agent's allocation decision with the firm optimum, and suggest how the firm can design salesforce incentives to better match objectives. We study the effect of agent's preferences, contract parameters and market forces on the agent's decision.

2 - Dynamic Pricing with Two Revenue Streams

Michael Li, Nanyang Business School, Nanyang Technological University, Singapore, Singapore, ZFLI@ntu.edu.sg, Weifen Zhuang

This paper studies the dynamic pricing problem with inventory revenue and ancillary revenue. If the inventory revenue dominates, we show that integrating ancillary revenue into dynamic pricing will set a lower inventory price. If the ancillary revenue dominates, we extend dynamic pricing with homogeneous customers to incorporate multiple segments differentiated through ancillary revenues. Our findings should shed new light on customer valuation and profiling.

3 - Business Metrics and a Revenue-optimal Policy

Darius Walczak, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dwalczak@prospricing.com

Optimization in RM and Pricing is typically focused on finding revenue-optimal policies but there are business metrics that are of interest in practice such as load factor, risk, or expected demand under revenue-optimal policy. It is also important for users of a pricing system to be able to balance tradeoffs between those metrics. We present some approaches to calculate those other quantities of interest under optimal policies, both static and dynamic. We include numerical examples.

■ TA32

H-Room 504, Fifth Level

Financial Risk Measures: Properties and Extensions

Cluster: Financial Engineering
Invited Session

Chair: Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu

1 - Synthetic CDO's: Towards a Large Deviations Theory

Richard Sowers, Professor, Department of Mathematics, University of Illinois at Urbana Champai, Urbana, Il, United States of America, r-sowers@illinois.edu

We discuss rare events in a tranched pool of credit default swaps (i.e., a synthetic collateralized debt obligation). We seek to use the theory of large deviations to understand the structure of investment-grade tranches, where, by definition, the losses are rare. We indicate how the theory of large deviations can address some aspects of dynamics, heterogeneities, and correlation.

2 - Set-valued Risk Measures for Markets with Transaction Costs

Andreas Hamel, Princeton University, ORFE, Sherrerd Hall, Charlton Street, Princeton, United States of America, ahamel@princeton.edu

The notion of monetary measures of risk is extended to markets with conical transaction costs. Primal representation results are given in terms of acceptance sets. For the convex case, a dual representation theorem is proven in terms of pairs of dual variables consisting of vector probability measures and elements of the positive dual of the solvency cone. Example are given and a scalarization procedure is described which allows an effective computation of values of set-valued risk measures.

3 - A Satisficing Alternative to Prospect Theory

David Brown, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States of America, dbbrown@duke.edu, Melvyn Sim, Enrico De Giorgi

We introduce a target-based model of choice that allows decision makers to be both risk averse and risk seeking, depending on the security of a position's payoff relative to a target. This captures in spirit two celebrated ideas: the satisficing concept from Simon and the switch between risk aversion and risk seeking behaviors from prospect theory. We show that this approach is dual to that of risk measures and that it results in resolution of some of the classical paradoxes (Allais, Ellsberg).

4 - Extensions of VAR

Uma Ravat, University of Illinois at Urbana-Champaign, Urbana, Il, United States of America, ravat1@illinois.edu, Uday Shanbhag, Richard Sowers

Risk measures are important objects of modern financial theory. The theory of coherent risk measures, in particular, identifies a collection of risk measures which satisfy some natural requirements from the point of finance. While these requirements are in theory, desirable,the banking industry uses Value at Risk as its standard, which in general is not coherent. We consider the coherent extension of Value at Risk.

■ TA33

H-Room 505, Fifth Floor

Incentives in Supply Chain Design

Cluster: Economic Models in Operations Management
Invited Session

Chair: Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Harish.Krishnan@sauder.ubc.ca

1 - A Time Management Framework for Entrepreneurial Process Improvement

Onesun Yoo, PhD Candidate, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, onesun.yoo.2010@anderson.ucla.edu, Charles Corbett, Guillaume Roels

For many entrepreneurs, the main bottleneck resource of their company is their own time, rather than cash. We develop a dynamic time-management framework for entrepreneurial process improvement for contexts where time is more constrained than cash, and provide clear guiding principles for time management. We highlight the comparative statics of the optimal policy. Our model formally links time with money and introduces a framework for evaluating the opportunity cost of an entrepreneur's time.

2 - Bargaining and Contracting in Dual Format Retailing
Benny Mantin, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L3G1, Canada, bmantin@engmail.uwaterloo.ca, Harish Krishnan, Tirtha Dhar

We explore the strategic implications of dual format retailing, wherein retailers use both merchant and platform formats. While in the former the retailer buys and resell the goods, in the latter he merely offers his retailing space to other sellers for some fees. Using a bargaining framework between the retailer and an upstream manufacturer, we allow the retailer to commit to the transaction fee charged from other sellers on the platform, or set it contingent on the outcome of the bargaining.

3 - Operational Collaboration Among Competitors
Milind Sohoni, Indian School of Business, India, milind_sohoni@isb.edu, Harish Krishnan

Collaboration among competitors carries both benefits and risks. Collaborations can lower costs benefitting the firms and customers. On the other hand operational collaborations can also alter the competitive dynamics in the industry. In this paper we analyze when should firms enter into operational collaborations with competitors, and how should such collaborations be structured? We also consider the welfare implications of agreements that sustain collaboration.

4 - Cost-raising Strategies in Distribution System Design
Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Harish.Krishnan@sauder.ubc.ca, Maurice Queyranne

A manufacturer sells a product through an online retailer and a competing retailer. The online retailer has a strong "outbound" distribution network, and has to decide whether to manage its "inbound" logistics internally or to allow the manufacturer to perform this function. "Internalizing" inbound logistics impacts the costs of all firms. Therefore, even if its costs go up, the online retailer may benefit from logistics internalization because of the cost impact on its competitor.

■ TA34

H-Room 520, Fifth Floor

Disaster Preparedness and Response

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: F. Sibel Salman, Assistant Professor, Koc University, Koc University Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, ssalman@ku.edu.tr

1 - Stocking Decisions for Relief Aid
Muge Karaman, Research Assistant, Koc University, Koc University Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, mkaraman@ku.edu.tr, F. Sibel Salman

In this study,we consider stocking decisions for relief aid agencies.We present a mathematical model to determine the optimum stocking decision for agencies that stock the same commodity for their own use and work in full cooperation.The model is based on wellstudied newsvendor model but extends to incorporate the disaster risk by regarding the disaster probability and the demand distribution under a disaster.We describe the use of this approach by a real life case analysis for Istanbul,Turkey

2 - When Should a Firm Donate Excess Inventory?
Hugh Medal, Doctoral Student, Industrial Engineering Department, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hmedal@uark.edu

Because of the difficulty in predicting demand, manufacturing plants, warehouses, and retailers may end up with excess inventory. In any time period, a firm may decide to donate their excess items, dispose of them, or wait for the items to sell. Donating excess inventory is an attractive option because of the resulting tax benefits. In this presentation, we examine the decision of when a firm should donate their excess inventory.

■ TA35

H-Sapphire A, Fourth Floor

Game Theoretic Applications in Healthcare I

Sponsor: Health Applications
Sponsored Session

Chair: Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, endmuratkurt@yahoo.com

1 - Hospital Stockpiling for Influenza Pandemics with Pre-set Response Levels
Po-Ching DeLaurentis, Indiana Health Services Research Fellow, Indiana University, 410 W. 10th St., Suite 2000, Indianapolis, IN, 46202, United States of America, chenp@purdue.edu, Elodie Adida, Mark Lawley

This is a game theoretic model of hospital stockpiling of medical supplies in preparation for flu pandemics. We consider a network of hospitals with mutual aid relationships for supply sharing during a pandemic. We assume the surge demand is a function of the flu attack rate that follows a known distribution. Each hospital pre-sets its pandemic response level and decides the stockpile level that minimizes its expected overall cost.

2 - Yield Uncertainty, Information Asymmetry, and Influenza Vaccine Supply Chain Coordination
Javad Nasiry, Ph. D. Student, INSEAD, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Javad.NASIRY@insead.edu, Stephen Chick, Sameer Hasija

We model information asymmetry in the flu vaccine supply chain with yield uncertainty, and design an optimal menu of contracts that the vaccine buyer (the government) can offer to the supplier (the manufacturer) in order to induce efficiency, and produce a system optimal vaccine volume.

3 - Influenza Vaccine Supply Chain with Multiple Agencies
Hamed Mamani, Assistant Professor, University of Washington, University of Washington, Seattle, WA, 98195, United States of America, hmamani@u.washington.edu, Stephen Chick, David Simchi-Levi

The current flu vaccine supply chain presents challenges for coordinating the incentives of for-profit vaccine manufacturers and those of public-health minded governments. We show how multiple governments, each with different sensitivities to the economics of treatment, can lead to suboptimal global health outcomes if each acts in its own national interest. We also show how financial transfers can align goals of different nations and improve vaccine coverage where it is most needed.

4 - The Optimal Timing of Prearranged Paired Kidney Exchanges
Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Andrew Schaefer, M. Utku Unver, Mark S. Roberts

Paired kidney exchanges (PKE) alleviate the shortage in the supply of kidneys for transplantation. We consider the transplant timing in a PKE and formulate the resulting problem as a non-zero sum stochastic game. We present necessary and sufficient conditions to characterize the stationary equilibria of this game. We bring the equilibrium selection into focus and characterize the welfare maximizing equilibrium as an optimal solution to an MIP.

■ TA36

H-Sapphire B, Fourth Floor

Optimization of Patient Scheduling Under Uncertainty

Sponsor: Health Applications
Sponsored Session

Chair: Ayca Erdogan, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, saerdoga@ncsu.edu

1 - Optimal Daily Assignment of Surgeries to Operating Rooms
Serhat Gul, PhD Candidate, Arizona State University, Department of Industrial, Systems and, Operations Engineering, Tempe, AZ, 85281, United States of America, sgul1@asu.edu, John Fowler, Brian Denton

In this talk, we present a multi-stage stochastic programming model for the assignment of surgeries to operating rooms (OR). Each day a number of surgeries in a daily list are scheduled while the rest is canceled and transferred to the next day's surgical list. The objective is to minimize the surgery cancellation cost and the overtime cost for OR. We solve the program using a progressive hedging algorithm.

2 - Colonoscopy Scheduling with Limited Resources
Bjorn Berg, NCSU, 375 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu, Brian Denton

Colonoscopy is a cost-effective means for colorectal cancer screening. Due to the high demand and cost of operating an endoscopy suite, it is crucial that careful planning of resources and patient scheduling be done. Limited resources in the intake, procedure, and recovery areas create scheduling challenges that can lead

to system congestion. We use a discrete event simulation model to explore heuristics for scheduling an endoscopy suite under uncertainty, including the presence of no-shows.

3 - Radiation Therapy Treatment Scheduling
Antoine Saure, PhD Student, Sauder School of Business, University of British Columbia, 503-930 Seymour St., Vancouver, BC, V6B1B4, Canada, antoine.saure@sauder.ubc.ca, Martin Puterman, Jonathan Patrick

Motivated by the adverse effect of delays on patients' health such as physical distress and deterioration of quality of life, and the inefficiencies in the use of expensive resources, we develop a model for scheduling multi-priority patients into Radiation Therapy treatment units. The main purpose of this model is to allocate available capacity to incoming demand, while achieving wait time targets and increasing treatment units utilization.

■ TA37

H-Sapphire C, Fourth Floor

Capacity Investment and Pricing Decisions in Operations Management

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Ana Muriel, Associate Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, muriel@ecs.umass.edu

Co-Chair: Betul Lus, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, blus@wustl.edu

1 - Volume Flexibility with Multiple Products and the Tradeoff with Product Flexibility
Manu Goyal, Assistant Professor, Robert H. Smith School of Business, University of Maryland, mgoyal@rhsmith.umd.edu, Serguei Netessine

We analyze volume flexibility under endogenous pricing with multiple products. We prove that the value of volume flexibility is a function of demand correlation between products, an outcome which cannot be explained by classical risk-pooling arguments. Our results underscore the value and the necessity of studying volume flexibility with multiple products, and emphasize the contrast with product flexibility.

2 - A Model of Strategic Sourcing under Limited Supply
Abdullah Dasci, York University, 4700 Keele Street, Toronto, ON, M3J 2V1, Canada, dasci@yorku.ca, Kemal Guler

An economic model for a strategic buyer that faces a duopolistic upstream market will be presented. The buyer needs to procure either from two suppliers who act strategically or from a third non-strategic source. The suppliers are assumed to have limited capacities, which are the main source of strategic interactions among the firms. The problem is analyzed under simple design decisions and the impact of these decisions on firm profits and purchase prices are explored.

3 - Technology Development and Capacity Investment on Flexibility Platform
Li Jiang, Assistant Professor, Hong Kong Polytechnic University, CF 721 LMS Department, Hung Hom, Hong Kong - PRC, L.Jiang@inet.polyu.edu.hk

We consider two factors that support a manufacturing system with volume flexibility. One is the technology investment on production process that affects production cost, whereas the other is capacity investment to regulate production scale. We characterize the investments in technology and capacity, and production decisions in both a monopoly and a competitive duopoly, and study the effects of market uncertainty and competition structure.

4 - Using Product Substitution in the Design of Production Networks
Betul Lus, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, blus@wustl.edu, Ana Muriel, Stephan Biller

We investigate the benefits of producing substitutable products in different plants over producing them in the same plant. The assignment of substitutable products to different plants adds a weak flexibility link to the production system through the substitution effect, and results in reduced capacity investment levels and higher profits. The benefits increase as products become more substitutable and/or demand variability increases.

■ TA38

H-Sapphire D, Fourth Floor

Empirical Research in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, 10027, United States of America, molivares@columbia.edu

1 - Drivers of Inventory Levels at US Retailers
Sampath Rajagopalan, University of Southern California, Los Angeles, CA, 90089, United States of America srajagop@marshall.usc.edu

This study explores the impact of fundamental factors identified in the inventory literature on inventories carried by US retailers using data obtained from primary and secondary sources. We explore the impact of factors such as gross margin, product variety as measured by number of SKUs, economies of scale as measured by sales per store, demand fluctuations, etc. We find that these factors are significant in explaining retailer inventories and explain most of the variance in inventory levels.

2 - Scarcity Rents in Car Retailing: Evidence From Inventory Fluctuations at Dealerships
Jorge Silva-Risso, Associate Professor, Marketing, University of California, Riverside, 900 University Avenue, 201 Anderson Hall, Riverside, CA, 92521, United States of America, jorge.silva-risso@ucr.edu, Florian Zettelmeyer, Fiona Scott Morton

Price variation for identical cars at the same dealership is commonly assumed to arise because dealers with market power price discriminate among their customers. We show that while price discrimination may be one element, price variation also arises from inventory fluctuations, which create scarcity rents for cars that are in short supply. The price variation due to inventory fluctuations thus functions to efficiently allocate cars that are in restricted supply to customers who value them most.

3 - Does Abnormal Inventory Growth Predict Earnings of Retailers?
Saravanan Kesavan, Assistant Professor, University of North Carolina, CB #3490, McColl Building, Chapel Hill, 27516, United States of America, skesavan@unc.edu, Vidya Mani

Forecasting earnings is a key activity in financial markets. Earnings of a firm depend on, among other factors, its sales and operating expenses. In this paper we investigate if abnormal inventory growth contains useful information to predict earnings of retailers. We find that abnormal growth in inventory contains information that is predictive of future earnings and can be used to improve forecasts from time series methods as well as Wall Street analysts.

4 - Inventory Performance in the U.S. Auto Industry
Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, 10027, United States of America, molivares@columbia.edu, Gerard Cachon

In this paper, we conduct an empirical study of the main drivers of finished goods inventory performance in the US automobile industry. We find that two factors explain about 70% of the variation in inventory across manufacturers: (1) the number of dealerships; (2) production flexibility. We also explore the impact of recent segment shifts in demand on inventory performance.

■ TA39

H-Sapphire E, Fourth Floor

Models for Managing Upstream Supply Risk and Information Asymmetry

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Damian BeilAssistant Professor, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

1 - Optimal Procurement Design in the Presence of Supply Risk
Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Aadhaar Chaturvedi

This paper analyzes optimal auctions when the delivery of supply is not certain. We consider a buyer facing multiple potential suppliers, each having an associated (exogenous) risk of supply failure. We design optimal mechanisms in presence of informational asymmetry for different scenarios, dependent on the buyer's level of information regarding the suppliers' reliability.

2 - Delegating Procurement Decision under Supply Risk and Asymmetric Information

Zhibin (Ben) Yang, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, zhibiny@umich.edu, Goker Aydin, Volodymyr Babich, Damian Beil

We model the manufacturer delegating procurement to one of its two unreliable suppliers under asymmetric information. The suppliers may collaborate to fulfill the order. Compared to the direct contracting scheme, delegation may cause the manufacturer to induce less or more diversification. Consequently, the manufacturer may earn less or more profit under delegation. We further show that delegation causes these effects only if the suppliers' reliabilities are asymmetric information.

3 - Competition Under Generalized Attraction Models: Applications to Quality Competition Under Yield Uncertainty

Nan Yang, Assistant Professor, Cornell University, ny38@cornell.edu, Awi Federgruen

We characterize the equilibrium behavior in a broad class of competition models, in which the competing firms' market shares are given by an attraction model, and the aggregate sales in the industry depend on the aggregate attraction value according to a general function. While most existing competition papers with attraction models can be viewed as special cases of this general model, we apply our general results to a new set of quality competition models under yield uncertainty.

4 - Impact of Information Asymmetry on the Supply Disruption under Different Disruption Timings

Ying-Ju Chen, University of California, Berkeley, IEOR Department, Berkeley, CA, 94720, United States of America, chen@ieor.berkeley.edu, Tianhu Deng, Max Shen

In a make-to-order production system, any supply disruption happens during the production lead-time may cause the failure to deliver the products on time. In this talk, we investigate various timings of supply disruption and their impact on the supply chain performance, sourcing decisions, and risk mitigation strategies.

■ TA40

H-Sapphire H, Fourth Floor

Inventory Management of Substitutable Products

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Amr Farahat, Cornell University, 370 Sage Hall, Ithaca, NY, 14853, United States of America, aaf33@cornell.edu

1 - Assortment Planning for Vertically Differentiated Products

Dorothee Honhon, University of Texas at Austin, 1, University Station, Austin, TX, 78712, United States of America, Dorothee.Honhon@mccombs.utexas.edu, Xiajun (Amy) Pan

We consider the problem of determining the optimal assortment of vertically differentiated products. When prices are fixed, we find that the optimal assortment depends on the distribution of customer valuations. However, it is not the case when prices are decision variables. We develop effective algorithms to identify the optimal product assortment in both cases and discuss valuable insights.

2 - Robust Newsvendor Competition under Asymmetric Information

Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Houyuan Jiang, Sergei Savin

We generalize analysis of competition among newsvendors to a setting in which competitors possess asymmetric information about future demand realizations, and this information is limited to the knowledge of the support of demand distribution. We show that, contrary to the intuition, a competing newsvendor does not necessarily benefit from having better information about its demand distribution than information that competitors have.

3 - Assortment Planning: A Sensitivity Analysis

Ramnath Vaidyanathan, University of Pennsylvania, Wharton School, Philadelphia, PA, 78733, United States of America ramnathv@wharton.upenn.edu

In this paper, I explore the sensitivity of the optimal assortment and profit to the mis-specification of the choice model and ignoring stock-out substitution. I use simulations to study the sensitivity and also develop bounds on the optimality gap in terms of demand variability, in-stock rate and assortment size.

4 - The Dynamic Substitution Problem with Pricing

Amr Farahat, Cornell University, 370 Sage Hall, Ithaca, NY, 14853, United States of America, aaf33@cornell.edu, Joonkyum Lee

We study the problem faced by a centralized decision maker managing several substitutable products in a newsvendor setting. Using affine approximations to the DP problem, we investigate heuristics that perform well compared to existing approaches. These heuristics are then embedded in a larger problem that incorporates pricing under the MNL model.

■ TA41

H-Sapphire L, Fourth Floor

Joint Session SPPSN/LA/MIF: Community-Oriented Operations Research

Sponsor: Public Programs, Service, and Needs & Location Analysis Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy Public Aff, McCormack Hall 3-428A, Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu

1 - Spatial Uncertainty and Location Modeling: Implications for Sex Offender Mitigation Strategies

Tony Grubesic, Associate Professor, Indiana University, Department of Geography, Bloomington, IN, 47405, United States of America, tgrubesi@indiana.edu, Alan Murray

Residence restrictions are increasingly popular policy tools for managing the spatial distribution of sex offenders in the U.S. Often implemented with limited empirical guidance, it is likely that data uncertainty regarding sex offender locations and restriction zones within a community jeopardizes the development of effective public policies. The purpose of this paper is to examine the impacts of spatial uncertainty in the development of models to support sex offender mitigation strategies.

2 - The Stop-and-drop Problem for Food Bank Distribution

Christina Scherrer, Assistant Professor, Southern Polytechnic State University, Department of Industrial Engineering Tec, 1100 South Marietta Parkway, Marietta, GA, 30060, United States of America, cscherre@spsu.edu, Senay Solak, Ahmed Ghoniem

In the Stop-and-drop problem, donated food is delivered from a central food bank warehouse to several "drop" locations, where multiple organizations travel to pick up their food. This allows the food bank to disperse food to rural areas without sacrificing the efficiency typical to more densely populated areas. For the resulting NP-complete problem, we present decomposition based efficient solution algorithms, and provide computational results.

3 - Investigating the Effects of Partnerships on Local Public Health Agencies

Natalie Privett, PhD Candidate, Stanford University, Department of Management Science & Engin, Production & Operations Management, Stanford, CA, 94305, United States of America, nprivett@stanford.edu, Sergey Sotnikov, Gulzar Shah, Pinar Keskinocak, Feryal Erhun

Collaboration in the U.S. public health system is critical to improving public health. The expectations are that by partnering, local health departments may leverage additional financial resources for public health programs, but net effects are unclear. The principal goal of this project is to provide quantitative evaluation of the effects of partnerships on revenue generating strategies of local health departments, ultimately providing a map of optimal strategies for partnering.

4 - How Can Community-Based Practitioners Improve Planning and Operations with Management Science?

Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy Public Aff, McCormack Hall 3-428A, Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu, Felicia Sullivan, David Turcotte

Housing and community development organizations primarily serve low- and moderate income communities, designing policies and services to minimize cost and maximize service quality and social equity. Such organizations rarely use management science to help them achieve these goals. We report results of a study to provide community organizations with the opportunity to evaluate spreadsheet-based management science applications that solve problems that are central to their mission.

■ TA42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Announcement of the Wagner Prize Winner

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS
Invited Session

Chair: Allen Butler, President, Daniel H Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Wagner Prize Winner

Allen Butler, President, Daniel H Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

The winner of the 2009 Daniel H. Wagner Prize for Excellence in Operations Research Practice will be announced. The winner will then give a reprise of the previous day's presentation.

■ TA43

H-Room 400, Fourth Floor

Approximation Algorithms for Stochastic Inventory Control Problems

Cluster: Supply Chain Models
Invited Session

Chair: Retsef Levi, Assistant Professor, Sloan, School of Management, MIT, 50 Memorial Drive Building E53-389, Cambrideg, MA, 02142, United States of America, retsef@MIT.EDU

1 - Stock Optimization in Emergency Resupply Networks under Stuttering Poisson Demand

Jie Chen, Operations Research and Information Engineering, Cornell University, Rhodes Hall 257, Cornell University, Ithaca, NY, 14850, United States of America, jc562@cornell.edu, Peter Jackson, John Muckstadt

We consider a network in which field stock locations (FSL) stock multiple parts according to an (S-1,S) policy under stuttering Poisson demand. Regular replenishment occurs from a regional stock location with unlimited supply. Demand in excess of inventory at a FSL is routed to an emergency stock location (ESL). We focus on the problem of determining the best stock levels at the FSLs and ESL to minimize holding, backorder, and emergency resupply costs subject to a network budget constraint.

2 - Near-Optimal Algorithms for Assortment Planning under Dynamic Substitution and Stochastic Demand

Vineet Goyal, Postdoctoral Associate, MIT, 77 Massachusetts Ave, E40-111, Cambridge, MA, 02139, United States of America, goyalv@MIT.EDU, Retsef Levi, Danny Segev

We consider a single-period assortment planning problem under a dynamic-substitution model with stochastic demand and give a polynomial time approximation scheme (PTAS) for the problem under fairly general assumptions that computes a near-optimal assortment with only a constant (depending only on the accuracy level) number of product types. We also present several complexity results for the problem that indicate that our assumptions are almost 'necessary' to solve it efficiently.

3 - Approximation Algorithms for Stochastic Lot-sizing Inventory Control Models

Cong Shi, PhD Candidate, Massachusetts Institute of Technology, Apt 396C, 70 Pacific St, Cambridge, MA, 02139, United States of America, shicong@MIT.EDU, Retsef Levi

We develop new algorithmic approaches to compute provably near-optimal policies for multiperiod stochastic lot-sizing inventory models with stochastic, non-stationary and correlated demands that evolve over time. This is one of the core models in inventory theory that has challenged researchers and practitioners for several decades. These policies that we develop have worst-case performance guarantees and perform very close to optimal in computational experiments.

4 - A Constant Approximation Algorithm for the *a Priori* TSP

David Shmoys, Professor, Cornell University, 231 Rhodes Hall, Hoy Road, Ithaca, NY, 14853, United States of America, shmoys@cs.cornell.edu, Kunal Talwar

For the TSP, we seek a tour T of a set N to minimize its total length c(T). In the a priori TSP, there also is a probability dist. P over subsets of N. A tour T induces a tour T(A) of length c(T(A)) for a subset A by omitting the points not in A. The value of an a priori tour T is its expected length w.r.t a random choice of A drawn according to P, E[c(T(A))]; we seek a T to minimize this. We give constant approx. alg. if P is specified by an independent activation prob. p(j) for each j in N.

■ TA44

H-Room 402, Fourth Floor

Educating Students in Service Sciences Panel Session

Sponsor: Service Science
Sponsored Session

Chair: Leonard Bohmann, Associate Dean of Engineering, Michigan Tech, 712 Minerals & Materials Engn Bldg, 1400 Townsend Dr., Houghton, MI, 49931, United States of America, ljbohman@mtu.edu

1 - Educating Students in Service Sciences

Leonard Bohmann, Associate Dean of Engineering, Michigan Tech, 712 Minerals & Materials Engn Bldg, 1400 Townsend Dr., Houghton, MI, 49931, United States of America, ljbohman@mtu.edu, Lou Freund, John McCreery

The panel will introduce the educational programs for educating students in service sciences that are presently in place at three US universities; Michigan Tech, North Carolina State, and San Jose State Universities. Although each program has its own focus, all three involve a collaboration between Business and Engineering. A discussion will follow on curriculum, program organization, and industry interactions.

2 - MS in ISE - Service Systems Engineering with Six Sigma Black Belt Option

Lou Freund, Professor and Chair, Department of Industrial & Systems Engineering, San Jose State University, 1 Washington Square, San Jose, CA, 95192-0085, United States of America, louis.freund@sjsu.edu

We have recently created an interdisciplinary emphasis area in our MS in ISE degree program that enables students to focus on Service Systems Engineering. An added feature is an option to obtain a Black Belt in Service Quality. This presentation will outline the program structure and prerequisites.

■ TA45

H-Room 410, Fouth Floor

Strategies for Managing Incremental and/or Radical Innovation

Cluster: New Product Development
Invited Session

Chair: Raul Chao, Darden Graduate School of Business, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, chaor@darden.virginia.edu

1 - Connecting Industry to Science

Bruno Cassiman, IESE Business School and KULeuven, Avenida Pearson 21, Barcelona, Spain, bcassiman@iese.edu, Reinhilde Veugelers, Sam Arts

The paper studies the role of IMEC, a world leading independent research institute in the area of nanotechnology, as a bridge between science and industry. Our patent dataset defining the span of IMEC consists of more than 20,000 unique inventors and 4,500 unique applicants, including around 2,300 companies, 100 universities and 100 research centers. We examine the underlying mechanisms through which such industry-science links affect the innovation performance of organizations and inventors.

2 - Beyond Ambidexterity: Understanding the Balance between Exploration and Exploitation

Drew Hess, University of Virginia, P.O. Box 400173, Charlottesville, VA, United States of America, hess@virginia.edu, Sam Ransbotham

It is established that innovation requires ambidexterity -balancing exploration and exploitation. We move beyond the question of whether ambidexterity is important and instead focus on understanding this balance. Although the term balance implies an even ratio of exploratory to exploitive projects,it is unlikely that an even ratio is optimal. We examine the composition of this ratio and the patterns of firm exploration and exploitation choices by analyzing 34K projects in the pharma industry.

3 - The Big Picture: Exploring the Performance Implications of Being at the Technological Frontier

Om Narasimhan, University of Minnesota, 321 19th Ave. South, Minneapolis, United States of America, naras002@umn.edu, Prokriti Mukherji, Madhu Viswanathan, Rajesh Chandy

We examine the performance impact of operating at the technological frontier in high-tech markets, and how firms' decisions to outsource core technologies impacts the likelihood of being at the frontier. We address these issues in the context of the digital television industry in the North American, Japanese, and European markets.

4 - Organization Structure, Incentives, and the Innovation Portfolio
Raul Chao, Darden Graduate School of Business, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, chaor@darden.virginia.edu, Stylianos Kavadias

In an attempt to deliver significant growth beyond the near term, many organizations have turned to grassroots innovation - bottom-up processes that access the ideas of all employees in the organization. Institutionalizing grassroots innovation is difficult because it requires interaction between employees that span the entire breadth and depth of the organization. In this study we explore the organization structures and incentives that help or hinder grassroots innovation initiatives.

■ TA46

H-Room 411, Fourth Floor

Modularity in Business Models, Processes and Logistics

Sponsor: Technology Management
Sponsored Session

Chair: Anu Bask, Senior Advisor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, anu.bask@hse.fi

1 - Modular Business Models in Logistics
Mervi Rajahonka, Researcher, Helsinki School fo Economics, POB 1210, Helsinki, 00101, Finland, mervi.rajahonka@hse.fi, Anu Bask, Markku Tinnila

This paper looks at business models based on modular service structures at logistics service providers. Business models have become a tool for developing services with novel earning models, service channels and service processes. We believe that modularity in business models can solve many of the development challenges and offer service flexibility. The findings show that modularity approach provides a background for development of service offerings, business models and processes.

2 - Intellectual Capital or Intellectual Property: Which is More Important for Regional Economic Development?
Nitin Mayande, Portland State University, Charles Weber

A comprehensive analysis of US patent data from 1995 to 2005 suggests that wealth (as measured by GDP per capita) of (US) states increasingly depends upon the density of of intellectual property rather than the density of intellectual capital. Attracting corporate headquarters to a region contributes significantly to regional prosperity. The study identifies clear winners and losers among US states.

3 - Modular Business Processes in Financial Services
Thomas Frandsen, Ph.D. Fellow, Copenhagen Business School, Solbjerg Plads 3 B5.19, 2000 Frederiksberg, Denmark, tfr.om@cbs.dk

The principles of modularity have become increasingly important for the design of flexible business process architectures. A central question is how modular processes are developed and used to realize the benefits of flexibility. This paper investigates the development and reuse of standardized process components within the context of a financial service provider. Of particular interest are the consequences of modular process architecture on transaction characteristics and firm capabilities.

4 - Modular Service Structures: Case E-business Logistics
Mervi Lipponen, Researcher, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, mervi.lipponen@hse.fi, Markku Tinnila, Anu Bask

In the past years, continuous progress in e-commerce has taken place. Logistics has proved to be an important factor in implementing e-commerce. Consequently, this paper discusses the effects of the Internet sales channel on the physical delivery of goods and brings up features in logistics structures that are specific to e-commerce. Our special interest is on changes in service structures and logistics business models as well as opportunities of modularity and related technological solutions.

■ TA47

H-Room 412, Fourth Floor

New Frontiers in Global Sourcing

Cluster: Global Sourcing of Services
Invited Session

Chair: Natalia Levina, Associate Professor, NYU, Kaufman Management Center, 44 West 4th Street, Room 8-78, New York, NY, 10012, United States of America, nlevina@stern.nyu.edu

1 - Drivers Of Output Quality In Offshore Outsourcing: Evidence From Field Research
Ravi Aron, Assistan Professor, John Hopkins University, The Carey Business School, 100 N. Charles St. Room 11-15, Baltimore, MD, 21201, United States of America, raviaron@jhu.edu, Praveen Pathak, Ying Liu

We investigate how inter-organizational monitoring mechanisms (information systems) complement the use of contractual mechanisms such as penalties and incentives to deliver optimal output quality in the offshore outsourcing of services. We also explore how work structure, contractual clauses and monitoring across boundaries of the firm interact over time to produce to quality outcomes. Our analysis is based on extensive data collected in field research.

2 - Redefining Organizational Boundaries? The Outsourcing of Core Innovation Activities
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, Phanish Puranam

The rise of outsourcing calls into question traditional notions of firm boundaries, as core tasks are increasingly performed by external vendors. This paper sheds light on the so emerging disaggregated organization, by examining the performance effects of challenges and management of global R&D projects conducted by a leading Indian outsourcing provider with its clients. The findings enhance our understanding of the evolving modern firm, outsourcing implementation, and innovation management.

3 - Services Nearshoring: An Empirical Perspective on Location Determinants
Eugene Hahn, Associate Professor, Salisbury University, 1101 Camden Ave., Salisbury, MD, 21801, United States of America, edhahn@salisbury.edu, Kraiwinee Bunyaratavej

While academic research involving services offshoring has increased, little empirical research has explored the sourcing alternative of nearshoring, despite the fact that firms situate about one out of five projects abroad in a nearshore location. We find that risk and service skill level influence firm decision-making regarding services offshoring location choices, and that the factors that drive nearshoring are qualitatively different than those that influence offshoring.

■ TA48

H-Sapphire Green Room, Fourth

Service Design and Strategy

Cluster: Service Operations Management
Invited Session

Chair: Liana Victorino, University of Victoria, P.O. Box 1700 STN CSC, Victoria, BC, V8W 2Y2, Canada, lianav@uvic.ca

1 - Strategic Priorities in Service Operations: Speed-quality Trade-off
Hongsuk Yang, Seoul National University, 599 Gwanangno Gwanak-gu, Seoul, 151-916, Korea, Republic of, hongsuk@snu.ac.kr, Sangwook Park, Dahyoun Park

There were numerous studies attempting to classify services and propose service operations strategies. Many of them claimed the trade-off between cost and flexibility in services. In this study, we propose time and quality trade-off in service operations strategy using service product/process matrix. This will help service firms enhance their understanding of service features and better develop an operations strategy.

2 - Exploring Consumer Reactions to Tipping Guidelines: Implications for Service Quality
Ekaterina Karniouchina, Assistant Professor of Marketing, Chapman University, One University Drive, Orange, CA, 92866, United States of America, karniouc@chapman.edu, Rohit Verma, Himanshu Mishra

This experimental study looks at the relative effectiveness of gratuity guidelines that are used by the restaurants in order to encourage the patrons to be more generous with the wait staff. The results indicate that service quality moderates the influence of tipping guidelines on resulting gratuity.

3 - Investigating Behavioral Sequence Effects into Large Scale Scheduling Problems
Michael Dixon, PhD Candidate, Cornell University, G-80 Statler Hall, Ithaca, NY, 14853, United States of America, mjd295@cornell.edu, Rohit Verma

OM scholars have recently begun to investigate the relationship of human behavior and operations decisions. In this study we begin to incorporate past behavioral research findings into large scale planning and scheduling problems. Using a unique archival data source provided by a renowned performing arts venue, we propose strategy to schedule events in such a way that incorporates peak and end effects in order to improve repurchase of season subscriptions.

■ TA49

H-Room 300, Third Floor

Contingent Efficiency of Global Supply Chain and Logistics

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: John Liu, Chair Professor of Maritime Studies, The Hong Kong Polytechnic University, Department of Logistics and Maritime Studies, Hung Hom, TST, Kowloon, Hong Kong - PRC, lgtjliu@polyu.edu.hk

1 - Computational Characteristics of Degenerate Production Frontier
Jianfeng Mao, The Hong Kong Polytechnic University, The Hong Kong Polytechnic University, Hong Kong, Hong Kong - ROC, maoeco@live.com, John Liu

This paper is concerned with computational optimization of nonsmooth production frontier with degenerative inputs, an active research topic that arises from contingent situations, such as the financial crisis of 2008, where economic growth and production outputs usually evolve through nonsmooth paths due to inevitable discrete choices and contingent changes in certain input factors. An efficient method is developed for nonsmooth frontier analysis based on the separability of degenerative inputs.

2 - Inventory Control with Uncertainty Supply and Fixed Setup Cost
Yunzeng Wang, Dr., University of California Riverside, 900 University Avenue, Riverside, CA, United States of America, yunzeng.wang@ucr.edu, Song Yuyue

We consider the basic single item single location inventory control problem with random yield. In the literature, the common assumption for this type of systems is zero fixed setup cost for any replenishment. In this work, we will investigate the impact of positive fixed setup cost on the optimal inventory control policy.

3 - Regular-impulse Stochastic Control in Financial/Insurance Optimization Models
Jiguang (Laser) Yuan, PhD Candidate, Hong Kong PolyU, Department of Logistics and Maritime Stu, Hong Kong - PRC, laser.yuan@gmail.com, Michael Taksar

We consider a diffusion dividend optimization model for an insurance company, which can control the risk via reinsurance. The payment of dividends is subject to taxation and in addition there is a set-up cost of K is incurred. The objective is to maximize the present value of the dividends payments until the time of bankruptcy. We show how to solve this problem via regular-impulse control and show how the optimal policy depends on the parameters of the model.

4 - Dual Sourcing in Managing Supply Chain Risks
Ping Su, SUNY New Paltz, One Hawk Drive, New Paltz, NY, 12561, United States of America, sup@newpaltz.edu, Shuguang Liu

We study a global firm that operates two supply sites, each with its own supply process. The domestic site is an established site that has steady growth and more expensive. The foreign site is cheaper and has an evolving supply process, which is subject to both supply disruption risk and operational risks. We find the optimal allocation of capability between the two sites. Our results show that under certain utility functions the optimal allocation is independent of time.

5 - Transitional Efficiency: Dynamic Frontier under Controllable Inputs
John Liu, Chair Professor of Maritime Studies, The Hong Kong Polytechnic University, Department of Logistics and Maritime Studies, Hung Hom, TST, Kowloon, Hong Kong - PRC, lgtjliu@polyu.edu.hk, Xuesong Li

Facing contingent events such as the financial crisis of 2008, contingent measures are often introduced to establish a new steady state in the shortest possible time. Noting production frontier as a primary measure of steady-state efficiency, this paper registers a novel attempt to develop a dynamic frontier model of differential mixed variational inequality (DMVI) for transitional efficiency analysis.

■ TA50

H-Room 302, Third Floor

Sports and Entertainment

Contributed Session

Chair: John Kros, Associate Professor, East Carolina University, 3121 Bate Building, Greenville, NC, 27858, United States of America, krosj@ecu.edu

1 - Modeling a Tennis Ladder to Demonstrate Social versus Aggressive Competitive Behavior
Kellie Keeling, Assistant Professor, University of Denver, DCB Department of Statistics, MSC 8952, 2101 S. University Blvd., Denver, CO, 80208-8952, United States of America, kkeeling@du.edu, Tom Obremski

Tennis ladders are used by tennis facilities to encourage competition among players with relatively like skills.† We present a tennis ladder simulation model, created in order to examine the ability of aggressive, neutral, and non-aggressive players to advance over the course of the competition.† Applicability to business career development will be discussed.

2 - Scaling the House: Optimal Zoning for the Entertainment Venue
Naragain Phumchusri, PhD student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, naragain@gatech.edu, Julie Swann

In the entertainment venue, front seats are usually priced higher than those located further away since they provide closer views of the show. One of the decisions the venue's management needs to make is how to optimally scale the house. We study the optimal zoning decision when the demand function is affected by the distance from the stage. We characterize the decisions under different scenarios and examine the effects of price and distance sensitivity.

3 - Home Field Advantage in College Football: Some Perspectives
John Kros, Associate Professor, East Carolina University, 3121 Bate Building, Greenville, NC, 27858, United States of America, krosj@ecu.edu, Christopher Keller

Home field advantage in college football is estimated as 3/4 points. This estimate may be biased since individual teams have some control over selection/scheduling of their opponents. In order to account for this possible bias, this paper analyzes game results from continuous long running rivalries (CLR). There are 120 FBS teams; 79 teams have at least one CLR, and there are 105 CLR's as of the 2008 season. The home field advantage for CLR's is less than the common estimates of 3/4 points.

■ TA51

H-Room 303, Third Floor

Integer Programming

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu

1 - Lead Time Considerations for the Multi-Level Capacitated Lot-sizing Problem
Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Christian Almeder, Bernardo Almada Lobo

We study the multi-level capacitated lot-sizing problem with lead time where in each time period production needs to be scheduled on several machines. Two mixed integer programming models are proposed, which are solved by various solution methodologies.

2 - A Polyhedral Study of Lot-sizing with Supplier Selection
Yijia Zhao, University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States of America, yz4k@virginia.edu, Diego Klabjan

The standard economic lot-sizing problem assumes a single supplier is available. We study the problem with several suppliers each one of them exhibiting economies of scale. A complete polyhedral description of the uncapacitated case is provided. For the capacitated case, we propose a family of valid inequalities derived from standard lot-sizing and single node fixed charge problems.

3 - Solution Strategies for Dense MIPs
Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu, Vishal Surana

In this talk, we will first present theoretical results of approximation algorithms for dense MIP marketshare instances. These approximation algorithms produce very tight bounds in reference to the optimal solutions. Solution strategies for solving some of these dense MIP instances through cutting plane techniques will be discussed.

4 - Exact Sequential Simultaneous Up Lifting in Binary Knapsack Polytopes
Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu, Lauren Kubik

This talk describes how to perform exact sequential simultaneous up lifting of an arbitrary number of sets on the binary knapsack polytope. Both polynomial time and psuedo-polynomial time algorithms are presented. Some facet defining conditions are presented along with examples and a small computational study.

■ TA52

H-Room 304, Third Floor

Strategic Models of Marketing and Operations Interface

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Baris Ata, Professor, Northwestern University, MEDS Dept - Kellogg School of Management, 2001 Sheridan Road, Evanston, ID, 60208, b-ata@kellogg.northwestern.edu

Co-Chair: Canan Savaskan, Northwestern University, Kellogg Graduate School of Management, 2001 Sheridan Road / Leverone Hall, Evanston, IL, r-savaskan@kellogg.northwestern.edu

1 - Decentralizing Price and Lead-time Decisions under Competition
Pelin Pekgun, Solution Architect, OR, JDA Software Group, 1090 Northchase Pkwy, Suite 300, Marietta, GA, 30067, United States of America, pelin.pekgun@jda.com, Paul Griffin, Pinar Keskinocak

We study the impact of the decentralization of price and lead-time decisions as quoted by marketing and production, respectively, in a duopoly. We find that when the price competition in the market is less intense than lead-time competition, a decentralized strategy may dominate a centralized one. However, under intense price competition, firms may suffer from a decentralized strategy especially under high capacity. We also discuss cases when one or both firms may need to leave the market.

2 - Measuring Seat Value in Theaters
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Ramnath Vaidyanathan

We study how the ex-post seat value perceived by a patron attending an event in a theater/stadium drives his/her future willingness to pay. Using a proprietary dataset, we develop an empirical model quantifying the impact of increased satisfaction on a patron's future willingness to pay, controlling for customer attribute and seat location characteristics, to understand the linkage between RM and customer satisfaction for experience goods/services.

3 - A Revenue Management Approach to Improve Profitability of Remanufacturable Products
Canan Savaskan, Northwestern University, Kellogg Graduate School of Management, 2001 Sheridan Road / Leverone Hall, Evanston, IL, r-savaskan@kellogg.northwestern.edu, Mustafa Akan, Baris Ata

In this paper, we discuss ways in which revenue management concepts can be used to improve profitability of remanufacturable products.

■ TA53

H-Room 305, Third Floor

Advancements in Theory of Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Kiavash Kianfar, Assistant Professor, Texas A&M University, 239B Zachry, TAMU 3131, College Station, TX, 77843, United States of America, kianfar@tamu.edu

1 - Knapsack Cryptosystems Based on Recurrence Sequences
Bala Krishnamoorthy, Washington State University, Pullman, WA, United States of America, kbala@wsu.edu, William Webb, Nathan Moyer

Traditional knapsack cryptosystems are suspect to attacks using basis reduction (BR), or BR followed by integer programming (IP). We consider new constructions for knapsack cryptosystems based on recurrence sequences. The choice of each number in the representation of the message depends on the residue class of the previous number. Representation of these relations as linear inequalities results in impractically large numbers of constraints, thus making BR and IP attacks ineffective.

2 - Utilizing Partial Objective Function Inequalities for the Multi-item Capacitated Lot-sizing Problem
Esra Buyuktahtakin, Visiting Assistant Professor, University of Arizona, 1127 E. James E. Rogers Way, Engineering Building #20, Tucson, AZ, 85721, United States of America, esra@sie.arizona.edu, Joseph Hartman, Cole Smith

We derive valid inequalities based on the partial objective function of the multi-item capacitated lot-sizing problem (MCLSP) formulation. We then develop algorithms to strengthen these inequalities by employing lifting procedures. The inequalities can be utilized in a cutting-plane strategy, in which we perturb the partial objective function coefficients to identify violated inequalities to the MCLSP polytope. We also present computational experiments with the proposed valid inequalities.

3 - The Stochastic Lot-sizing Problems with Deterministic Demands and Wagner-Whitin Costs
Zhili Zhou, University of Florida, 303 Weil Hall Industrial and Systems Engineering, Gainesville, FL, 32611, United States of America, zlzhou@ufl.edu, Yongpei Guan

In this talk, stochastic lot-sizing problems with deterministic demands and Wagner-Within costs are considered. We examine properties for the optimal inventory and backlogging levels. We provide extended linear programming formulations to describe the integral polyhedral for the single-item uncapacitated case (SULS) and the single-item uncapacitated case with backlogging (SULSB) respectively, regardless of the scenario tree structure.

4 - Facet-defining Properties of N-step Mingling Inequalities for Mixed-integer Knapsack Sets
Kiavash Kianfar, Assistant Professor, Texas A&M University, 239B Zachry, TAMU 3131, College Station, TX, 77843, United States of America, kianfar@tamu.edu, Alper Atamturk

We show that the n-step mingling inequalities are facet-defining for mixed-integer knapsack sets if certain conditions on coefficients are satisfied (the facet-defining conditions for mingling and 2-step mingling inequalities are special cases of these conditions). This makes n-step mingling a novel method for generating facets for the general mixed-integer knapsack set, and presents new facets for this set.

■ TA54

H-Room 306A, Third Floor

Network Problems in Embedded Graphs

Sponsor: Optimization/Networks
Sponsored Session

Chair: Glencora Borradaile, Oregon State University, Corvallis, OR, United States of America, glencora@eecs.oregonstate.edu

1 - Homology Flows, Cohomology Cuts
Amir Nayyeri, University of Illinois at Urbana Champaign, 201. N. Goodwin, Urbana, United States of America, nayyeri2@uiuc.edu, Erin Wolf Chambers, Jeff Erickson

We describe the first algorithms to compute Maximum flows in surface-embedded graphs in near-linear time. Given an undirected graph embedded on an orientable surface of genus g, with two specified vertices s and t, our algorithm computes a maximum (s,t)-flow in in $O(g^7 n \log^2n \log^2C)$ time for integer capacities that sum to C, or in $(g \log n)^O(g) n$ time for real capacities. Except for the special case of planar graphs, for which an $O(n \log n)$-time algorithm has been known for 20 years, the best previous time bounds for maximum flows in surface-embedded graphs follow from algorithms for general sparse graphs. Our key insight is to optimize the relative homology class of the flow, rather than directly optimizing the flow itself. A dual formulation of our algorithm computes the minimum-cost cycle or circulation in a given (real or integer) homology class.

2 - Minimum Cuts and Shortest Homologous Cycles
Erin Wolf Chambers, Assistant Professor, St. Louis University, Department of Mathematics and Computer S, 220 N. Grand Blvd., St. Louis, MO, 63103, echambe5@slu.edu, Jeff Erickson, Amir Nayyeri

We describe the first algorithms to compute minimum cuts in surface-embedded graphs in near-linear time. Given an undirected graph embedded on an orientable surface of genus g, with two specified vertices s and t, our algorithm computes a minimum (s,t)-cut in g^{O(g)} n log n time. Except for the special case of planar graphs, the best previous time bounds for finding minimum cuts in embedded graphs follow from algorithms for general sparse graphs.

3 - Studying (non-planar) Road Networks Through an Algorithmic Lens
David Eppstein, Professor, University of California, Irvine, Department of Computer Science, Bren Hall, Irvine, CA, 92697, United States of America, david.eppstein@gmail.com, Michael T. Goodrich

We study the geometric graph properties of road networks, focusing on properties that can be exploited in the design of fast algorithms. Unlike previous approaches, we do not assume that road networks are planar graphs; empirically, road networks are quite non-planar. Instead we formalize these networks as "multiscale-dispersed graphs" via disk neighborhood systems. This approach leads to fast algorithms for shortest paths and Voronoi diagrams without assumptions about the edge weights.

4 - Network Sketching: How Much Geometry Hides in Connectivity
Nikola Milosavljevic, Ph.D. Candidate, Stanford University, 318 Campus Drive, Clark Center S257, Stanford, CA, 94305, United States of America, nikolam@stanford.edu, Stefan Funke

We consider a wireless sensor network deployed on a flat terrain and ask how much of its unknown geometric layout can be recovered if the only available information are pairs of nodes than can communicate. We show how to extract a "network sketch" — a planar subnetwork whose faces capture "network holes" (areas with no nodes), and whose planar embedding yields "virtual coordinates" for location-based sensor network protocols.

■ TA55

H-Room 306B, Third Floor

Covering Problems and Applications

Contributed Session

Chair: Alex Zhang, HP, 1501 Page Mill Road, M/S 1140, Palo Alto, CA, 94304, United States of America, alex.zhang@hp.com

1 - An Improved Greedy Algorithm for the Set Covering
Amnon Gonen, Dean, Management of Technolgy Faculty, Holon Institute of Technology, 52 Golomb St., Holon, Israel, agonen@hit.ac.il, Tzahi Avrahami

In this study we have to cover N sites by allocating minimum number of servers. Each server covers a predefined pattern and by locating it to a site K it covers its neighbors according to its pattern. The most common family of heuristic algorithms to the set covering problem is the Greedy type algorithms. The following study compares an Improved Heuristic Algorithm (IHA) with the Greedy one. The results showed that in most cases, for symmetric severs, the IHA finds better solutions.

2 - Approximation of the Capacitated Set Cover Problem with Splittable Demands
Myoung-Ju Park, Seoul National University, San 56-1 Shilim-Dong, Kwanahk Gu, Seoul, 151-742, Korea, Republic of, pmj0684@snu.ac.kr, Sung-Pil Hong

The capacitated set cover problem consists of a set of items and a collection of sets of items. Each item has a demand which can be split into the sets that contain it. We can use multiple copies of each and each copy can cover a total demand at most 1 with some cost. The goal is to find a minimum cost capacitated set cover. This paper will suggest a 1+H_k approximation algorithm when the cost of set is equal to each other, and a 2H_k approximation algorithm, otherwise, where H_k=1+1/2+...+1/k.

3 - Covering Path Problem with New Elements and Heuristics
Liyan Hua, PhD Student, Ohio State University, 600 Fisher Hall, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hua_20@fisher.osu.edu, David Schilling, John Current

We introduce facility capacity constraints to the maximum covering/shortest path problem. The problem is decomposed into a k-shortest path problem and a capacitated maximum covering problem. The k-sp problem is solved by a path deletion algorithm. The capacitated maximum covering problem is solved by various meta-heuristics including Tabu search and simulated annealing. These meta-heuristics are compared with each other and with previous approaches to the capacitated maximum covering problem.

4 - Supplier Consolidation Using Capacitated Set Covering
Alex Zhang, HP, 1501 Page Mill Road, M/S 1140, Palo Alto, CA, 94304, United States of America, alex.zhang@hp.com, Shailendra Jain, Jerry Shan, Cipriano Santos, Jose Luis Beltran

We present a method for identifying suppliers, among a large list of suppliers with whom an enterprise (such as HP) has done business with in the past, for supplier base consolidation. Further, when unit cost data of each supplier is available, we solve the problem of selecting suppliers to minimize the total procurement cost. We extend the classic set covering problem to capacitated set covering. Our method allows considerations of supplier capacity and supplier share limit.

■ TA56

H-Room 307, Third Floor

Methods for Large-Scale Nonlinear Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Philip Gill, Professor, University of California, San Diego, 9500 Gilman Drive, # 0112, La Jolla, CA, 92093-0112, United States of America, pgill@ucsd.edu

1 - Solution of a Stochastic Model for Allocation of On-line Advertising Inventory
John Tomlin, Yahoo! Labs, 701 First Avenue, Sunnyvale, CA, 94089, United States of America, tomlin@yahoo-inc.com, Vijay Bharadwaj, MIchael Saunders

We describe the stochastic extension of a transportation model with separable convex objective for optimal allocation of online advertising inventory for guaranteed delivery. Using the approach pioneered by Beale and Dantzig, we arrive at a stochastic model that is also convex and separable. We apply a C++ version of the primal-dual interior solver PDCO.

2 - An Interior-point Trust-funnel Algorithm for Large-scale Nonconvex Optimization
Daniel Robinson, Oxford University, Wolfson Building, Parks Road, Oxford, OX1 3QD, United Kingdom, daniel.p.robinson@gmail.com, Nick Gould, Philippe Toint

We discuss an interior-point trust-funnel algorithm for large-scale nonconvex optimization. Global convergence of our method is ensured by trust-region methodology combined with the so-called "funnel". The prominent features of our algorithm are that each subproblem may be solved approximately and that inexact SQP steps may be computed when deemed advantageous during the course of solving each barrier subproblem.

3 - SQP Methods for Nonlinear Optimization
Philip Gill, Professor, University of California, San Diego, 9500 Gilman Drive, # 0112, La Jolla, CA, 92093-0112, United States of America, pgill@ucsd.edu, Elizabeth Wong

We consider the formulation and analysis of sequential quadratic programming (SQP) methods for large-scale nonlinearly constrained optimization that may be "hot started" from a good approximate solution. In this context we focus on SQP methods that are best able to use "black-box" linear algebra software. Such methods provide an effective way of exploiting recent advances in linear algebra software for multicore and GPU-based computer architectures.

■ TA57

H-Room 308, Third Floor

Application of System Tools to Healthcare Engineering

Sponsor: Health Applications
Sponsored Session

Chair: Tze Chiam, PhD Candidate, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States of America, tzechao@purdue.edu

1 - Modelling the Future of the Canadian Cardiac Surgery Workforce
Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca, Sonya Vanderby

Corresponding to an increased use of non-surgical interventions, cardiac surgery rates have been declining in recent years. This reduction has affected job prospects for new grads, deterring current medical students from selecting the specialty. Reduced enrolment, coupled with the aging of both current cardiac surgeons and the general population is raising concerns about potential future shortages. Using system dynamics, we developed a simulation of the supply and demand for cardiac surgeons.

2 - A Bayesian Approach for Scheduling Low-acuity Patient in the Emergency Department
Shengyong Wang, Assistant Professor, The University of Akron, Mechanical Engineering Department, ASEC Room 101, Akron, OH, 44325-3903, United States of America, wangs@uakron.edu

Traditionally, Emergency Department (ED) does not operate based on appointments. While most low-acuity patients experience prolonged waiting time before being seen by a physician, mainly due to bed availability, they have some flexibility on their arrival time to the ED. Aiming at creating a balanced system and improving the patients' experience at the ED, a Bayesian model combining historical trends and real-time information was established to schedule low-acuity patients at ED.

3 - Optimizing Organ Procurement Coordinator Decision Making
Gozde Icten, University of Pittsburgh, zgi1@pitt.edu, Lisa Maillart

A ranked match list is generated for a donated liver and a coordinator aims to place the organ with a recipient as quickly as possible by proceeding down the list. The coordinator controls the number of simultaneous offers extended, and may resort to expedited placement if the process becomes lengthy. We model the coordinator's decisions as an MDP and perform both structural and numerical analysis.

4 - Placing Expedited Livers
Zeynep Erkin, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, zee2@pitt.edu, Lisa Maillart

To expedite organ placement, some livers (after proceeding through the standard match process for some time) are offered not to another individual patient, but rather to a transplant center. The center must then decide which, if any, of its patients should receive the organ, which involves a tradeoff between accepting an organ of relatively low quality versus waiting for potential future offers. We model and analyze this sensitive resource allocation problem as a large-scale average reward MDP.

■ TA58

H-Room 309, Third Floor

Resource Allocation and Logistics Problems

Cluster: Scheduling
Invited Session

Chair: Nicholas Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall.33@osu.edu

1 - Container Scheduling Problem
Kangbok Lee, Postdoc, New York University, Department Information, Operat and Management, 44 W. 4th ST, New York, NY, 10012, United States of America, klee3@stern.nyu.edu, Byung Cheon Choi, Joseph Y-T Leung, Michael L. Pinedo, Dirk Briskorn

We consider the problem of shipping containers from their origination ports to their destination ports. Ships have capacities and fixed routing schedules and each ship visits a number of ports. The goal is to assign containers to ships in order to optimize certain objectives related to completion times and due dates. We discuss the computational complexity of the problem and analyze some heuristics.

2 - Allocation of Jobs and Resources to Work Centers
Hui-Chih Hung, National University of Singapore, 1 Engineering Drive 2, Singapore, hhc43212@gmail.com, Marc Posner

We study a stochastic resource allocation problem where non-identical servers are partitioned into parallel work centers, and simultaneously job types are assigned to the centers. Each job type has a distinct Poisson arrival rate and WIP weight. The goal is to minimize total WIP cost. Heuristics are constructed for random and fastest available server assignment disciplines. Theoretical bounds are developed and heuristic performance is empirically evaluated.

3 - On the Container Vessel Scheduling with Time Window Constraints
Selim Bora, Rutgers University, NJ, United States of America, selimbora@gmail.com, Kristina Sharypova, Lei Lei

We consider the minimum-cost vessel scheduling problem involving many ports and time window constraints on vessel arrivals. In addition to the demand on cargo containers, each port has also a positive/negative demand on empty containers. We solve a special case by dynamic programming, and introduce a new greedy algorithm for the general cases.

■ TA59

H-Room 310, Third Floor

Tutorial: New Sphere Methods for LP

Cluster: Tutorials
Invited Session

Chair: Katta G. Murty, Professor, University of Michigan, Department of IOE, 1205 Beal Avenue, Ann Arbor, Mi, 48109-2117, United States of America, murty@umich.edu

1 - New Sphere Methods for LP
Katta G. Murty, Professor, University of Michigan, Department of IOE, 1205 Beal Avenue, Ann Arbor, Mi, 48109-2117, United States of America, murty@umich.edu

We discuss a new method being developed for solving solving linear programs that uses matrix inversion operations sparingly, and thus seems well suited to solve large scale problems, and those that may not have the property of being very sparse.

■ TA60

H-Room 311, Third Floor

Extensions and Applications of Linear and Cone Programming

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

1 - Gradient Based Method for Cone Programming and Applications
Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, Canada, zhaosong@sfu.ca

We consider four natural primal-dual convex smooth minimization reformulations for cone program (CP), and discuss a variant of Nesterov's smooth (VNS) method for solving them. The associated worst-case arithmetic operations costs of the VNS method for them are estimated and compared. We show that for a class of CPs, the VNS method based on the last one generally outperforms the others. Finally, we discuss some application to MAXCUT, Lovasz capacity, and compressed sensing.

2 - Interior-Point Methods for Mixed-Integer Nonlinear and Cone Programming Problems
Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu, Vivek Mahanta

In this talk, we will present details of an interior-point method for solving the nonlinear, second-order cone, and semidefinite programming subproblems that arise in the solution of mixed-integer optimization problems. Of particular concern will be warmstart strategies and infeasibility identification. Numerical results will be presented.

3 - Enhance System Performance for Energy Market
Deanne Zhang, Paragon Decision Technology, 5400 Carillon Point, Kirkland, WA, 98033, United States of America, Deanne.Zhang@aimms.com

For a Two-settlement Energy Market, ISO (Independent System Operator) is facing a series of mathematical problems with thousands of variables and constraints. How to get reliable solutions in short period of time is critical. Thus we are going to look at some helpful implementation techniques in AIMMS, including linearization of quadratic models, multiple-solver session schemes and sub-gradient calculation.

4 - A New Convex Quadratic Programming Relaxation for Binary Quadratic Programming Problems
Rui Yang, Graduate Student, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, ruiyang1@illinois.edu, Jiming Peng, Peng Jiang

We consider a special class of (0,1) binary quadratic programming problems (BQP) where the number of nonzero elements is fixed. We use the convex quadratic relaxation as a geometric embedding tool to reformulate the underlying BQP as a clustering problem where the target is to find a single cluster of fixed size. Incorperating with SDP relaxation technique, we propose a 2-approximation algorithm to solve this clustering problem. Numerical results are included as well.

■ TA61

H-Room 312, Third Floor

Facility Location

Contributed Session

Chair: Boonlert Wongcharoensangsiri, PhD Student, Department of Industrial Engineering, Texas Tech University, 2500 Broadway, Lubbock, TX, 79409, United States of America, boonlert.wongcharoensangsiri@ttu.edu

1 - The Optimal Location of Elevator for the Multi-floor Manufacturing Environment
Chikong Huang, Professor, Institute of Industrial Engineering and Management, National Yunlin University of Science & Technology, 123 University Road, Section 3, Department of Industrial Management, Touliu, Yunlin, 64002, Taiwan - ROC, huangck@yuntech.edu.tw, Ming-Ru Tsai, Jeng-Shin Chen

The location of elevator is an important layout issue especially for the multi-floor, automatic manufacturing plants. This research develops a mathematical model and associated solution procedure to find the optimal location for elevator. It is also assumed: (1) All transporting items are moved along a fixed and closed-

loop moving track on each floor. (2) The location of elevator can be arranged at any point on the closed-loop moving track. A numerical example is also demonstrated.

2 - Locating Service Centers under Service Level Constraints in Continuous Space

Prahalad Venkateshan, AmTrust Bank, 1801 East 9th Street, Cleveland, United States of America, prahalad@gmail.com, Kamlesh Mathur

In this paper, we develop a column generation-based algorithm addressing the problem of finding the optimal location of a given number of service centers in a continuous space servicing geographically distributed customer regions. Service is offered by mobile servers which travel to the customer regions and return back to the service center. The service level constraint is based on the probability of wait. The objective function comprises the transportation and staffing costs.

3 - Lower and Upper Bounds for a Capacitated Transshipment Point Location Problem with Handling Costs

Jinfeng Li, PhD Student, University of Technology of Troyes, 12 Rue Marie Curie, BP 2060, Troyes, 10000, France, jfli_1983@hotmail.com, Christian Prins, Feng Chu

We introduce a transshipment point location problem considering handling costs occurred at transshipment points. Decisions are made to locate capacitated transshipment points between capacitated plants and customers to transport various types of products. We propose a hybrid method including a Lagrangean relaxation, a column generation and a heuristic to provide lower and upper bounds of the problem. Computational results show that gaps between the upper and lower bound are within 2.5%.

4 - Robust Location of Staging Area in Wind Farm Logistics

Boonlert Wongcharoensangsiri, PhD Student, Department of Industrial Engineering, Texas Tech University, 2500 Broadway, Lubbock, TX, 79409, United States of America, boonlert.wongcharoensangsiri@ttu.edu, John Kobza

We present a staging area location assignment model for a wind farm logistics problem when the wind farm location is unknown. A minimax approach is applied to determine the robust solution for all possible wind farm locations. Two types of objective functions are studied. One is the total cost of staging area, inventory, and transportation. Another is the regret which is the added cost over the cost if the specific location of the wind farm were known when the site of the staging area is chosen.

■ TA62

H-Room 313, Third Floor

Behavioral Studies on Individual Factors and Performance

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Julie Niederhoff, Assistant Professor, Whitman School of Mangement, Syracuse University, 721 University Avenue, Syracuse, NY, 13244, United States of America, jniederh@syr.edu

1 - How to Set Goals? An Experimental Inquiry

José Larco, PhD. Candidate, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, 3000 DR, Netherlands, jlarco@rsm.nl, Kees Jan Roodbergen, Rene De Koster, Jan Dul

Setting goals for enhancing performance has been widely studied in the field of Industrial Psychology. However, questions remain for operations management: Which goal to set to optimize performance? How to recognize if a goal is adequately set? What is the effect of goals in the variability of performance (within and between subjects)? We conduct an experiment for answering these questions and validating a theoretical model that can be used to inform several other workflow operational models.

2 - Bargaining and Channel Coordination

Valery Pavlov, Penn State University, vpavlov@psu.edu, Elena Katok, Ernan Haruvy

We investigate the effect of the bargaining process on channel coordination. Earlier studies reported that coordinating contracts fail to coordinate or even increase efficiency beyond the levels of a simple wholesale price contract. The reason for this failure is that offers that result in an unequal relative profit split tend to be rejected. These past studies used a take-it-or-leave-it bargaining format. We investigate more flexible bargaining rules and find that they improve efficiency.

3 - Personal Factors and Contract Perfomance

Julie Niederhoff, Assistant Professor, Whitman School of Mangement, Syracuse University, 721 University Avenue, Syracuse, NY, 13244, United States of America, jniederh@syr.edu, Panos Kouvelis

Existing behavioral work in supply chain coordination contracts looks at the overall performance of contracts and finds them insufficient in average system improvement. We investigate the cause of these suboptimal decisions to determine how risk aversion and fairness concerns drive decision making in individual decision makers.

■ TA63

H-Room 314, Third Floor

Patient Scheduling

Contributed Session

Chair: Robert Storer, Professor, Lehigh University, 200 West Packer Av., Bethlehem, PA, 18015, United States of America, rhs2@lehigh.edu

1 - Constructing Nurse - To - Patient Assignments In A Neonatal Intensive Care Unit

Ilgin Acar, Doctoral Associate, Western Michigan University, Parkview Campus, Department of Industrial and Manufacturi, Kalamazoo, MI, 49008-5336, United States of America, ilgin.acar@wmich.edu, Steven E. Butt, Tycho Fredericks

This study considered a nurse-to-patient assignment problem in a neonatal intensive care unit at a southwest Michigan hospital. The resulting model includes constraints that take into account elements of a nurse's workload during a shift. Background regarding the unit under study will be briefly discussed and model assignments will be presented.

2 - A Sample Average Approximation Algorithm for Appointment Scheduling

Robert Storer, Professor, Lehigh University, 200 West Packer Av., Bethlehem, PA, 18015, United States of America, rhs2@lehigh.edu, Camilo Mancilla

We present algorithms for the appointment sequencing and scheduling problem with waiting, idle time and over time costs. The full stochastic problem is approximated using a scenario based sample average approach. The algorithms for the resulting stochastic integer programming problem are based on Bender's decomposition where the master problems are solved approximately by a fast heuristic.

■ TA64

H-Room 202A, Second Floor

Teaching OR/MS

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Eric Huggins, Associate Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

1 - What are Students NOT Learning in Introductory Statistics?

Susan Palocsay, Professor of Computer Information Systems and Management Science, James Madison University, CIS & MS Department, MSC 0202, Harrisonburg, VA, 22807, United States of America, palocssw@jmu.edu, Scott Stevens

Statistics is an essential prerequisite for OR/MS, and the challenges of effectively teaching introductory statistics are well known. Formal assessment of student learning in our introductory business statistics course over the past six years has provided us with documentation of specific problem areas. We report on overall student performance and present empirical data identifying the most common errors and misconceptions. We also suggest teaching approaches to address some of these errors.

2 - The Thoughtful and Effective Classroom

Xu Yang, University of Louisville, Department of Industrial Engineering, Louisville, United States of America, x0yang07@louisville.edu

The issue of how to develop an OR/MS class in a diverse student group is discussed. We introduce The New American Lecture Strategy as well as how to incorporate this strategy in a typical OR/MS classroom. By targeting students as different groups, different teaching styles and techniques can be used, such as an anticipatory set or hook, an advanced visual organizer, deep processing and periodic thinking. We believe that the novel strategy can make the class more thoughtful and effective.

3 - Teaching Lean Principles Using Hands-On Simulation: Experiences and Outcomes Across Universities

Sharon Johnson, Associate Professor, Worcester Polytechnic Institute, 100 Institute Rd, Worcester, MA, 01609, United States of America, sharon@wpi.edu

While lean thinking principles appear straightforward, practitioners need to critically examine processes, value drivers, and constraints to effectively apply them. We describe a pedagogical approach to teaching lean based on a hands-on simulation created by TimeWise Management Systems, used by 20 business and engineering programs. We contrast the implementation experience across programs, including material use, how learning was assessed, the support needed, and faculty observations.

4 - Teaching OM at a Liberal Arts College: Why Do I Have to Take This Class?

Eric Huggins, Associate Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

Operations management can be a challenging course for students majoring in operations, engineering or mathematics; for business students at a small, liberal arts institution, OM may be the most difficult course that a student will take in his or her college career. For example, consider linear programming: How does one teach and motivate students to learn such a hard topic? I will discuss successful teaching techniques that I have developed over the past seven years (and a few failures, too).

■ TA65

H-Room 202B, Second Floor

Panel Discussion: Challenges and Opportunities for Women in Academia

Sponsor: Women in OR/MS
Sponsored Session

Chair: Sadan Kulturel-Konak, Associate Professor, Penn State Berks, Management Information Systems, Reading, PA, 19610, United States of America, sadan@psu.edu

1 - Challenges and Opportunities for Women in Academia

Moderator: Sadan Kulturel-Konak, Associate Professor, Penn State Berks, Management Information Systems, Reading, PA, 19610, United States of America, sadan@psu.edu, Panelists: Lama Moussawi, Alice E. Smith, Elisabeth Pate-Cornell, Pinar Keskinocak

This panel will focus on different challenges and opportunities for women academics in Industrial Engineering and Operations Research areas. Panelists will discuss their unique perspectives of the issues affecting the success of women in academic and administrative positions in the US and in the Middle East countries.

■ TA66

H-Room 204A, Second Floor

Operations with Financial Concerns

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Rachel Zhang, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, Hong Kong - ROC, rzhang@ust.hk

Co-Chair: Gongtao (Lucy) Chen, Assistant Professor, National University of Singapore, 1 Business Link, NUS Business School, Singapore, 117592, Singapore, bizcg@nus.edu.sg

1 - Supply Chain Optimization with Financial Constraints and Cost of Financial Distress

John Birge, Professor, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, john.birge@chicagogsb.edu, Song (Alex) Yang

While supply chain contracts have been widely studied in the operations management literature, little attention has been been paid to how actual financial flows between firms influence the performance of a supply chain. In this talk, we formulate the firms' financing decisions and the cost of financial distress explicitly. We show that trade credit can improve supply chain performance, re-allocating the power between the supplier and the retailer.

2 - Financing the Newsvendor: Supplier vs. Bank, Optimal Rates, and Alternative Schemes

Wenhui Zhao, Washington University in St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63117, United States of America, ZHAO@olin.wustl.edu, Panos Kouvelis

Within a Stackelberg modeling framework, we explore the impact of trade credit contracts in a capital constrained supply chain, when break-even bank loans are available. We show that the supplier should always finance the retailer, and the retailer always prefers supplier to bank financing. While the supply chain and supplier's profits improve, the retailer might also improve his profits relative to bank financing, depending on his wealth. We also provide insights when bankruptcy costs exist.

3 - The Impact of Financial Turbulence on Inventory Control

Gongtao (Lucy) Chen, Assistant Professor, National University of Singapore, 1 Business Link, NUS Business School, Singapore, 117592, Singapore, bizcg@nus.edu.sg, Robin Roundy, Rachel Zhang, Lawrence W. Robinson

We incorporate financial uncertainties into a single-product, periodic-review, finite-horizon stochastic inventory system by modeling both the discount factors and operational costs as stochastic processes that evolve as financial uncertainties are realized. We establish conditions under which (s, S) policies are optimal. We also show that both the business type and the stockout protocol have large impacts on inventory decisions and on the cost penalty for ignoring the financial volatility.

■ TA67

H-Room 204B, Second Floor

Stochastic Nonparametric Approaches to DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi

1 - Data Envelopment Analysis as Nonparametric Least Squares Regression

Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi, Andy Johnson

We show that DEA can be interpreted as nonparametric least squares regression subject to shape constraints on frontier and sign constraints on residuals. Parametric programming (Aigner&Chu 1968) is thus a special case of DEA. Using these insights, we develop a nonparametric variant of COLS. We show that the new C2NLS method is consistent and asymptotically unbiased. The links established in this paper contribute to integration of the econometric and axiomatic approaches to efficiency analysis.

2 - Nonparametric Efficiency Estimation in the Presence of Contextual Variables

Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu, Timo Kuosmanen

Banker and Natarajan (2008) analyze 2-stage DEA models and quantify the detrimental effects of correlation between the inputs and the context through Monte Carlo simulation. We introduce two contextual variables models called 1-stage DEA and C2NLS in the presence of contextual variables (C2NLSCV) which allow for correlation between the contextual variables and the input levels. Monte Carlo simulation results are presented to demonstrate the superior performance of these estimators.

3 - Efficiency Analysis of Finnish Crop Farms by Stochastic Nonparametric Envelopment of Data (StoNED)

Nataliya Kuosmanen, MTT Agrifood Research Finland, Luutnantintie 13, Helsinki, 00410, Finland, nataliya.kuosmanen@mtt.fi, Timo Kuosmanen

Stochastic Nonparametric Envelopment of Data (StoNED) approach by Kuosmanen (2006) and Kuosmanen and Kortelainen (2007) combines the axiomatic, nonparametric DEA-style frontier with stochastic SFA-style inefficiency and noise terms. In this paper we apply the StoNED method to estimate farm-level efficiency scores in a sample of 141 Finnish crop farms specialized in wheat.

4 - Productivity Differentials in Dairy Farming - A Comparison of Methods

Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi, Subal Kumbhakar, Timo Sipilainen

The aim is to analyse the regional productivity differentials on dairy farms. We apply both econometric and mathematical programming methods including stochastic nonparametric estimation. The data of 954 farms is obtained from the EU's FADN data set for Denmark, Finland and Sweden in 2003. The results suggest that different methods provide slightly different results but in all approaches productivity differentials are considerable in favour of Danish farms.

■ TA68

H-Room 206, Second Floor

Sampling in Stochastic Optimization: Methodology and Application

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu

1 – Introducing CO2 Allowances: Higher Prices for All Consumers, Higher Revenues for Who?

Romeo Langestraat, Tilburg University, Dept. of Econometrics and OR, Tilburg, 5037 AB, Netherlands, r.langestraat@uvt.nl, Gul Gurkan, Ozge Ozdemir, Yves Smeers

Related to efforts of reducing CO2 emissions, we analyze the effects of introducing a cap-and-trade system or taxation on capacity investments under perfect competition using a two-stage Nash game. We illustrate how to solve these models as stochastic programs or complementarity problems under uncertainty, using sampling. We show that if there is shortage of transmission capacity in the system, only introducing a cap-and-trade system or taxation is neither sufficient to curb CO2 levels nor necessarily induces investments in cleaner technologies, respectively.

2 - Overlapping Batches for Variance Reduction in Optimality Gap Estimation in Stochastic Programming

David Love, Program in Applied Mathematics, University of Arizona, 617 N. Santa Rita Ave., Tucson, AZ, 85721-0089, United States of America, dlove@math.arizona.edu, Guzin Bayraksan

We investigate the use of overlapping batches for assessing solution quality in stochastic programs. Motivated by the original use of overlapping batch means in simulation, we present a variant of the multiple replications procedure that uses overlapping batches to decrease the variance of the optimality gap estimator, while leaving the bias unaffected. Theoretical and empirical results are given.

3 - Assessment of Solution Quality for Some Nonlinear Stochastic Problems Using Bootstrap

Fabian Bastin, Assistant Professor, Université de Montréal, Dpt of Computing Science and Oper. Res., CP 6128, Succ Centre-Ville, Montreal, H3C 3J7, Canada, bastin@iro.umontreal.ca

We consider minimization of problems based on Monte-Carlo draws obtained using physical data, which can be costly to obtain. Since independent samples are then difficult to construct, bootstrap appears appealing to evaluate estimations accuracy. We apply this approach on some specific problem classes and compare it to other popular techniques, which can be deficient when some assumptions are relaxed. We also briefly explore the use bootstrap in stopping criteria for more general problems.

4 - A Probability Metrics Approach for Bias and Variance Reduction in Optimality Gap Estimation

Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu, Rebecca Stockbridge

Monte Carlo sampling-based statistical estimators of optimality gaps for stochastic programs are known to be biased. We present a method for bias reduction in these estimators via a probability metrics approach, which can be done in polynomial time in sample size. We show that the resulting estimators after bias reduction produce consistent point estimators and asymptotically valid confidence intervals. Our preliminary computational results show that this procedure can also reduce variance.

■ TA69

H-Indigo A, Second Floor

PR Research Workshop

Cluster: Grassroots PR for Operations Researchers
Invited Session

Chair: Barry List, INFORMS, Hanover, MD, 21076, Barry.List@informs.org

1 - Grassroots PR: How You Can Leverage your Accomplishments and Make Headlines in Your Local News

Barry List, INFORMS, Hanover, MD, 21076, Barry.List@informs.org

Are you doing research that affects consumers, business people, government, and those who follow the news? Is your consulting work pleasing your clients but not registering with a broader world? Should local, national and online news take notice? In this workshop, INFORMS communications director Barry List will provide you with ways of leveraging your accomplishments with your university's or company's PR department, as well as the local press, to bring attention to best work. Attend only if you can bear the bright lights and attention of the new - and traditional - media.

■ TA75

C-Room 32A, Upper Level

Joint Session RAS/TSL: Recent Advances in Transportation Planning Systems

Sponsor: Railroad Applications & Transportation Science and Logistics
Sponsored Session

Chair: Ravindra Ahuja, President, Innovative Scheduling, GTEC, 2153 SE Hawthorne Road, Suite 206, Gainesville, FL, 32641, United States of America, ravi@innovativescheduling.com

1 - New Algorithmic Approaches for Solving the Curfew Planning Problem

Ashish Nemani, University of Florida, Department of Industrial and Systems, Engineering, Gainesville, FL, 32611, United States of America, aknemani@ufl.edu, Suat Bog, Ravindra Ahuja

We study the Curfew Planning Problem(CPP) encountered by railroads for the maintenance of tracks. The CPP is to design an annual schedule to complete a set of jobs (rail/tie-work) on the railway tracks for a set of crews specialized in rail or tie work. We develop the work schedule for each crew such that the disruptions in train routes are minimized. The solution must also satisfy several operational and regulatory requirements. Our paper presents several exact models and heuristics the CPP.

2 - A Simulation-based Decision Support System for Railroad Terminal Capacity Planning

Edward Lin, OR Analyst, Norfolk Southern Corporation, 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, edward.lin@nscorp.com, Clark Cheng

This paper presents a rail yard simulation framework that can be used to identify terminal capacity improvement opportunities. The framework provides the flexibility and adaptability to conduct and manage what-if analysis on train service plan, traffic mix, yard layout, operating policy, operational strategy, and resources. Therefore, the development time for a new yard can be reduced significantly. We describe the implementation of the framework in a major hump yard at Norfolk Southern.

3 - Multi-year Installation Design of Railroad Wayside Defect Detection Installations

Fan Peng, University of Illinois at Urbana-Champaign, 205 N. Matthews Avenue, B156, Urbana, IL, United States of America, fanpeng2@illinois.edu, Xiaopeng Li, Yanfeng Ouyang

Railroads use wayside inspection technologies to monitor health of railcars. Due to resource constraints, an efficient and feasible installation plan should be integrated into a multi-year deployment framework to derive the maximum benefit. We propose a large-scale network optimization model to solve this problem, and develop efficient solution techniques based on Lagrangian Relaxation. Numerical case studies illustrate the application of this model on real-world cases.

Tuesday, 11:00am - 12:30pm

■ TB01

C-Room 21, Upper Level

Portfolio Decision Analysis II

Sponsor: Decision Analysis
Sponsored Session

Chair: Alec Morton, Lecturer in Operational Research, London School of Economics, Houghton St, London, WC2A2AE, United Kingdom, A.Morton@lse.ac.uk

1 - The Impact of Stochastic Price Models on Portfolio Selection

J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu, Brandon Pope, James E. Smith

Significant advances have been made in our ability to model market prices that evolve stochastically through time. However, questions regarding the usefulness of these models remain. For example, in a portfolio setting, do price process models change project rankings or simply move all projects together? In this talk, we describe settings where price process models are important and those where they are not. This has important implications for the use of these models in practice.

2 - Tracking Project Flow in an R&D Portfolio: A Case Study
Jay Andersen, Sr Research Fellow, Eli Lilly & Co, Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, andersen_john_s@lilly.com

Traditional R&D Scorecards measure the progress of research programs in development by counting the number of programs that pass key milestones, and comparing this tally to annual targets. For the past 18 months, Lilly R&D has been tracking portfolio progress with a new Flow Scorecard. This new method for tracking progress has several advantages over the traditional method, providing governance committees access to a more sensitive and comprehensive tool for measuring portfolio progress.

3 - R&D Portfolio Investment Analysis with Approximate Dynamic Programming
Joseph Hartman, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, jchartman@ufl.edu, Pinar Keles, Jack Kloeber

We model the R&D portfolio investment process with stochastic dynamic programming. As the state space to represent a portfolio of projects is of high dimension, we employ approximation techniques to extend the horizon of analysis and ensure good time zero decisions while also providing a procedure to validate our solutions.

4 - Optimizer's Curse in Project Portfolio Selection
Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, 02015, Finland, ahtisalo@cc.hut.fi, Juuso Liesiö, Bert De Reyck

Portfolios are often built by selecting the projects with the best expected performance. Because the prior performance estimates are uncertain, this selection process gives rise to the optimizer's curse phenomenon so that the prior estimates of selected projects tend to be higher than their actual performance. We analyze how this phenomenon depends on the performance estimates and the share of projects that are selected. We also consider implications for the design of selection processes.

■ TB02

C-Room 22, Upper Level

Information and Learning in Operations Management

Sponsor: Decision Analysis
Sponsored Session

Chair: Canan Ulu, University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Canan.Ulu@mccombs.utexas.edu

1 - Information Gathering Through Different Channels in Newsvendor Problems
Canan Ulu, University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Canan.Ulu@mccombs.utexas.edu, James E. Smith

We study information gathering policies in a multi-period newsvendor problem if the demand distribution is unknown. Previous models study information gathering through observed demand or sales; we assume that in addition to choosing an order quantity, the newsvendor has the option to gather additional information about demand prior to placing his order. We discuss structural properties of the optimal profits and order quantities.

2 - Learning in Spatial Product Differentiation Models
Dorothee Honhon, University of Texas at Austin, 1, University Station, Austin, TX, 78712, United States of America, Dorothee.Honhon@mccombs.utexas.edu, Aydin Alptekinoglu, Canan Ulu

A firm decides the assortment of products to offer in a given category, over a 2-period horizon. Customer preferences are represented by a one-dimensional spatial differentiation model but the firm does not know the exact distribution of customer preferences. Given a prior distribution, the firm decides how many products to offer and where to locate them. After observing the (possibly censored) sales in period 1, the firm updates the prior and determines the assortment in period 2.

3 - Simulation Calibration with Correlated Knowledge-Gradients
Peter Frazier, Assistant Professor, Cornell University, Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu, Warren Powell, Hugo Simao

We consider calibration of an approximate dynamic programming model used by the logistics company Schneider National. Each run of the model requires approximately 12 hours of CPU time and produces noisy non-stationary output, making calibration difficult. We show how the knowledge gradient algorithm may be used to adaptively search through the space of parameter settings to quickly and effectively find a parameter vector that is among the best at causing model output to match historical data.

4 - Acquisition of Project-specific Assets with Bayesian Updating
Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu, Steven Lippman

We study the effect of learning on the optimal policy and the time-to-decision in a sequential decision model with two irreversible alternatives, exit and expansion. In our model, the firm undertakes a small-scale pilot project with a noisy return so as to learn, via Bayesian updating, about the project's profitability before making the expansion or exit decision. As the speed of learning increases, the continuation region expands, but the time-to-decision does not monotonically increase.

■ TB03

C-Room 23A, Upper Level

Multi-Criteria Decision Making

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Mark Karwan, Professor, University at Buffalo, 305 Bell Hall, Buffalo, NY, 14216, United States of America, mkarwan@eng.buffalo.edu

1 - A Heuristic Approach for Multiobjective Combinatorial Optimization
Murat Koksalan, Middle East Technical University, IE Department, ODTU, Ankara, 06531, Turkey, koksalan@ie.metu.edu.tr

We develop a heuristic approach to approximately represent the nondominated points of multiobjective combinatorial optimization problems. The approach is based on fitting a surface that passes through a small number of available nondominated solutions. We demonstrate its performance on a number of problems and discuss possible uses.

2 - An Objective Decomposition-coordination Method for Interactive Decision-Making
Alexander Engau, Assistant Professor, University of Colorado Denver, Mathematical and Statistical Sciences, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, aengau@alumni.clemson.edu, Margaret Wiecek

To facilitate trade offs and preference articulation in multi-criteria decision-making, a decomposition scheme is proposed that restructures the original problem into smaller subproblems with only subsets of the original criteria. A priori preferences on trade offs are integrated into this process by modifying the Pareto order by general domination cones, and decision makers are supported by an interactive procedure to coordinate any remaining trade offs using concepts of approximate efficiency.

3 - Linear/linear Multiobjective Bilevel Programs
Herminia I. Calvete, Associate Professor, University of Zaragoza, Statistical Methods Department, Pedro Cerbuna 12, Zaragoza, 50009, Spain, herminia@unizar.es, Carmen Gale

Bilevel programs are characterized by the existence of two optimization problems, in which the constraint region of the upper level problem is implicitly determined by the lower level optimization problem. This talk focuses on bilevel programs with multiple objectives at the lower level. In the linear case, we prove some geometrical properties of the feasible region and the global optimal solution. Some ideas are given on algorithms to solve the problem.

4 - An Interactive Approach for Multicriteria Implicit Alternatives Using a Tchebycheff Utility Function
Ozgen Ozbey, PhD Candidate, University at Buffalo, 418 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 14260-1900, United States of America, oozbey2@buffalo.edu, Mark Karwan

We propose an interactive multicriteria method for implicit alternatives to help a Decision Maker (DM) obtain a most preferred solution. We present an MILP formulation to generate multipliers which are consistent with a DM's response to pairwise comparisons. We approximate the DM's utility function by a Tchebycheff function or a hybrid function combining Tchebycheff and linear components. Computational results and comparisons with various utility functions and other methods are presented.

■ TB04

C-Room 23B, Upper Level

Integration of Data Mining and Statistical Process Control

Sponsor: Data Mining
Sponsored Session

Chair: Seoung Bum Kim, Assistant Professor, Korea University, Anam-dong Seongbuk-Gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

1 - Dectection of a Change in Poisson Count Data under Non-homogeneous Population

Sung Won Han, PhD Candidate, Georgia Institute of Technolgoy, Altanta, GA, United States of America, shan@isye.gatech.edu, Kwok Tsui, Yajun Mei

The topic is about the on-line monitoring problem of detecting a mean change of Poisson distributions under non-homegenous population. The most common detection scheme is the generalized likelihood ratio statistics, which is known as an optimal method under Lodern's criteria. However, alternative detection schemes we proposed perform better than generalized likelihood ratio statistics. The properties of the detection schemes are investigated both theoretically and by numerical simulation.

2 - A Nonparametric T2 Control Chart for Multivariate Process Monitoring

Poovich Phaladiganon, Ph.D. Student, University of Texas at Arlington, Arlington, TX, United States of America, poovich@gmail.com

In this study, we extend the ideas of using the bootstrap method in univariate control charts to multivariate control chart, called the bootstrap percentile approach. This approach is determined as an alternative to construct the control limit based on T2 statistics. A simulation study was conducted to measure the performances of the proposed approach, kernel density estimation (KDE), and T2 control chart. The proposed method performed better than T2 chart while it is comparable to KDE.

3 - A Linkage Ranking Algorithm for Multivariate Quality Control

Panitarn Chongfuangprinya, Ph.D. Candidate, University of Texas at Arlington, United States of America, panitarn.chongfuangprinya@mavs.uta.edu, Seoung Bum Kim, Helen Bush, Victoria Chen

When the assumption of normally distributed quality characteristics is invalid, traditional multivariate quality control methods may not be as desirable as nonparametric methods. The nonparametric method in this paper constructs charts based on the ranking of the new measurement relative to the training data, and new algorithm for calculating ranks are presented. Simulations are performed to demonstrate the effectiveness of our method and their superiority over Hotelling's T2.

4 - One-Class Classification-based Control Charts for Monitoring Multivariate and Autocorrelated Process

Weerawat Jitpitaklert, Ph.D. Candidate, University of Texas at Arlington, Arlington, United States of America, weerawat.net@gmail.com, Seoung Bum Kim, Thuntee Sukchotrat

Statistical process control for multivariate and autocorrelated process has received a great deal of attention. We propose a one-class classification method to deal with multivariate and autocorrelated process. By using simulated data, analysis and comparison of the one-class classification-based control charts and the traditional Hotelling's chart are presented.

■ TB05

C-Room 23C, Upper Level

Panel Discussion: Quality Improvement in Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

1 - Quality Improvement in Nanomanufacturing

Moderator: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu, Panelists: C F Jeff Wu, Chuck Zhang

Nanomanufacturing poses tremendous challenges and opportunities for quality and productivity improvement. The panelists will discuss the research issues and opportunities in nanomanufacturing and share their experience.

■ TB06

C-Room 24A, Upper Level

Recent Advances in Computer Experiments II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Peter Qian, Assistant Professor, University of Wisconsin-Madison, 1300 University Ave, Department of Statistics, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Construction of Orthogonal and Nearly Orthogonal Latin Hypercubes

Devon Lin, Construction of Orthogonal and Nearly Orthogonal Latin Hypercubes, Queen's University, Jeffery Hall, University Ave., Kingston, ON, Canada, devon.lin@queensu.ca, Rahul Mukerjee, Derek Bingham, Randy Sitter, Boxin Tang

An important yet challenging research problem in the area of computer experiment is to develop a general methodology for the construction of good designs with high dimensionality. Recently, a useful approach that has been gaining momentum focuses on the construction of orthogonal and nearly orthogonal Latin hypercubes. We will introduce two powerful methods that build large designs using small ones. We will also examine how to make use of both methods to obtain a useful collection of orthogonal or nearly orthogonal Latin hypercubes.

2 - A Kriging Approach to the Analysis of Climate Model Experiments

Dorin Drignei, Oakland University, Mathematics and Statistics, Rochester, MI, 48309, United States of America, drignei@oakland.edu

A climate model is a computer implementation of a mathematical model for the physical, chemical and biological processes underlying the climate. These models are computationally intensive, allowing only small computational experiments. We present a multidimensional kriging method to predict climate model variables at new inputs, such as new greenhouse gas and aerosol concentrations, based on the experimental data available.

3 - A Simple Approach to Integrated Emulation for Computer Experiments

Qiang Zhou, University of Wisconsin Madison, ISyE Dept, 1513 University Avenue, Madison, WI, 53706, United States of America qzhou3@wisc.edu, Shiyu Zhou, Peter Qian

We consider prediction of computer experiments with multiple responses which are correlated. Specially designed correlation structure has been proposed to improve predictions by combining several responses together. The proposed method can be realized through simple modifications of univariate Kriging method, and is able to provide better prediction.

■ TB07

C-Room 24B, Upper Level

Quality and Reliability in Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

Co-Chair: Abe Zeid, Northeastern University, College of Engineering, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zeid@coe.neu.edu

1 - Bayesian Process Control of Buckypaper Manufacturing for Improved Quality and Repeatability

Arda Vanli, Florida State University and Florida A&M University, 2525 Pottsdamer Street, Tallahassee, United States of America, oavanli@eng.fsu.edu

Despite developments in processing technology, repeatability and part-to-part variability in carbon nano-tube composites remains important. A challenge in nano-manufacturing is that due to the high cost of raw materials, sufficient experimentation required to build accurate statistical models may often be very expensive. We propose a Bayesian predictive approach that allows incorporating prior process knowledge and optimization of buckypaper manufacturing processes from small experimental sets.

2 - Developing a Process Model to Monitor the Growth of Molecular Beam Epitaxy Nanomanufacturing Process

Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

This paper addresses the quality and repeatability of MgO thin films grown on a 6H-SiC substrate. Molecular Beam Epitaxy process is employed to grow these films with controlled structural, and stoichiometric and functional properties. Using the historical data, we conducted Design of Experiments (DOE) to analyze the interactions among process variables and their influence on the quality parameters.

3 - Self-Assembled Templates for Device Fabrication on Si Wafer and Roll-to-Roll® Process Platforms

James Watkins, University of Massachusetts, oom A616 Conte Research Center, Amherst, United States of America, watkins@polysci.umass.edu

The fabrication of nanotechnology enabled devices requires not only the creation and functionalization of well defined nanostructures, but also practical routes for the two and three dimensional integration of these structures with components and systems across multiple length scales. Approaches for the use of self-assembled block copolymer templates to achieve these goals for sub-10 nm elements using either Si wafer or roll to roll processing platforms will be discussed.

■ TB08

C-Room 24C, Upper Level

Special Problems in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48859, United States of America, shaha1s@cmich.edu

1 - Use and Abuse of Regression

Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48859, United States of America, shaha1s@cmich.edu

Regression is used for relating a dependent variable with many independent variables. The relationship is then judged by R-squared. Also, data is collected overtime which may have serial correlation. However, many published articles show regression with less than .5 R-squared and some do not even include the Durbin-Watson test. Such articles are not based on sound statistical analysis. My paper will discuss the use of appropriate statistical methods for sound, acceptable research.

2 - Prioritizing Which Data to Collect Next When Predicting System Reliability

Christine Anderson-Cook, Los Alamos National Laboratory, P.O. Box 1663 MS F600, Los Alamos, NM, 87544, United States of America, candcook@lanl.gov

When analyzing reliability of a complex system, several types of data from full-system tests to component level tests may be available. After a preliminary analysis, additional resources may be available and we wish to identify the best new data to collect to maximally improve the prediction of system reliability. Methodology is presented about selecting appropriate criteria to rank different allocations, and determining what new data to collect to improve our understanding of the response.

3 - Intrinsic Complexity of Classification Problems

Tin Kam Ho, Group Leader, Statistics and Learning Research, Bell Labs, Alcatel-Lucent, 600 Mountain Ave., 2C-381, Murray Hill, NJ, 07974, United States of America, tkh@research.bell-labs.com

Successful application of classification methods depends on a good match between the method and the task. This requires understanding of both the classifier's behavior and the characteristics of the problem. We describe some measures that characterize intrinsic data complexity and its relationship to classifier performance, and discuss results on identifying the domains of dominant competence of several popular classifiers in this measurement space.

■ TB09

C-Room 25A, Upper Level

Numerical Methods for Stochastic Controls

Sponsor: Applied Probability
Sponsored Session

Chair: Jim Dai, Edenfield Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332, United States of America, dai@gatech.edu

1 - Contracting on the Process of Discovery

Xingwen Zhang, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, xingwenz@stanford.edu, Sunil Kumar

We model the alliances between pharmaceutical companies and biotech companies for drug discovery as continuous-time principal-agent problems. We consider an additional source of risk beyond usual imperfect effort monitoring, namely, the success or failure of the discovery process whose hazard rate depends on the effort. We characterize the optimal contracts via the solution to an HJB equation, illustrate these contracts via numerical computation and simulation, and empirically test our findings.

2 - Drift Control with Changeover Costs

Melda Ormeci Matoglu, Ozyegin University, Kusbakisi Cad No 2, Altunizade, Istanbul, Turkey, Melda.Ormeci@ozyegin.edu.tr, John Vande Vate

We model managing capacity in a BTO environment as a Brownian drift control problem. With a practical restriction we model it via a structured LP and show an optimal solution to the restricted problem can be found among a special set of policies. We exploit new relationships between complementary dual solutions and relative value functions to obtain a lower bound on the avg. cost of any nonanticipating policy. We show that our LP approach is asymptotically optimal for the unrestricted problem.

3 - A Computational Method for Stochastic Impulse Control Problems

Kumar Muthuraman, Professor, McCombs School of Business, kumar@austin.utexas.edu, Haolin Feng

We consider the instantaneous control of a diffusion process on the real line. The cost of control has both fixed and proportional components. The objective is to minimize the expected infinite horizon discounted costs. Standard dynamic programming arguments result in a Quasi-Variational-Inequality (QVI). We present a method to efficiently solve the QVI and show that it monotonically converges to the optimal solution. We also present error bounds and application examples.

■ TB10

C-Room 25B, Upper Level

Queueing

Sponsor: Applied Probability
Sponsored Session

Chair: Alan Scheller-Wolf, Associate Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu

1 - Real-time Pricing Under Uncertainty for Loss Systems

Robert Hampshire, hamp@andrew.cmu.edu, Cathy Xia

We consider real time services where the demand function is unknown. Arriving customers pay the announced price upon admission and expect to receive service at a specific quality level. When the system capacity is full, arrivals are lost. Our goal is to develop a profit maximizing joint pricing and capacity planning decision method for real time services in the face of uncertain stochastic demand. Applications include e-services and street parking price management.

2 - Dynamic Control of Parallel Flexible Servers Under the Risk of Disruption: The 'W' Network Network

Soroush Saghafian, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, soroush@umich.edu, Mark Van Oyen, Bora Kolfal

We address the problem of assigning flexible servers to different job types in a general parallel queueing framework where servers are heterogeneous and subject to stochastic disruptions. We investigate the structure of the optimal policy and develop a strong heuristic that outperforms the well-known available policies.

3 - An Analytical Approximation for a Closed Fork/Join Network with Multi-Station Input Subnetworks

Erkut Sonmez, Assistant Professor, Boston College, Carroll School of Management, Fulton, Hall, 140 Commonwealth Ave, Chestnut Hill, MA, 02467, United States of America, esonmez@andrew.cmu.edu, Alan Scheller-Wolf, Nicola Secomandi

Fork/join stations are used for modeling synchronization between entities, and fork/join queueing networks are natural models for a variety of communication and manufacturing systems. In this paper, we present a simple approximation method to estimate the throughput of a closed queueing network that features a single fork/join station receiving inputs from multi-station subnetworks.

4 - Design and Analysis of Diagnostic Service Centers
Xiaofang Wang, Renmin University of China, School of Business, Beijing, China, xiaofang.wang@gmail.com, Alan Scheller-Wolf, Stephen F. Smith, Laurens Debo

Nurse lines are call centers that provide advice to patients about what the most appropriate course of action is according to their symptoms. We build a model to help nurse line managers decide on the optimal service depth and the staffing level to effectively perform a diagnostic process between agents and customers. We analyze properties of the optimal decision and obtain insights into an enhanced understanding of the fundamental trade-offs in nurse-line management practice.

■ TB11

C-Room 25C, Upper Level

Queueing Applications in Manufacturing and Maintenance

Cluster: Queueing Models
Invited Session

Chair: Isilay Talay Degirmenci, Duke University Fuqua Business School, 1 Towerview Drive, Durham, NC, 27708, United States of America, it@duke.edu

1 - A State-dependent Markov Chain Model for Cycle Time Estimation of Complex Manufacturing Systems
Raha Akhavan-Tabatabaei, North Carolina State University, E. P. Fitts Department of Ind and Sys Eng, Raleigh, NC, 27695, United States of America, raha.akhavan.tabatabaei@gmail.com, Shengwei Ding, J. George Shanthikumar

Classical queueing models often overestimate the cycle time of complex manufacturing systems. One root cause for this inaccuracy is their underlying assumption of independence between the arrival and service processes.We develop a state-dependent Markov chain model for a single stage multi-server queue with heterogeneous servers. The arrival and service rates of this system are dependent on the WIP and the number of working tools. We show that this model predicts the cycle time more accurately.

2 - Evaluation of Assembly/Disassembly Queueing Networks with Blocking and General Service Times
Michael Manitz, University of Cologne, Supply Chain Management & Production, Köln, 50923, Germany, manitz@wiso.uni-koeln.de

We study multi-stage tree-structured assembly/disassembly queueing systems with finite buffers, generally distributed service times, and synchronization constraints at assembly and disassembly stations. To approximate the throughput of such a queueing network and to estimate the variance of the inter-departure times at the stations, a decomposition approach is used. It requires a system of decomposition equations. The quality of the presented approach is tested against simulation results.

3 - Scheduling Policies in the Repair Shop for the Spare Parts Provisioning Problem
Robert Svaluto, University of Toronto, 5 King's College Rd., Toronto, ON, M5S 3G8, Canada, svaluto@mie.utoronto.ca, Baris Balcioglu

The system being considered consists of two different types of repairable components, as well as an inventory for each type. The repair shop is modelled as a single server queue, where First Come First Serve, non-preemptive priority, and myopic policies are investigated as possible repair shop scheduling policies. The performance of these policies will be compared with the optimal policy with the objective of minimizing the system cost, which includes holding and backordering costs.

4 - Performance-based Dimensioning of the Machine-repairmen Problem
Isilay Talay Degirmenci, Duke University Fuqua Business School, 1 Towerview Drive, Durham, NC, 27708, United States of America, it@duke.edu, Otis Jennings

Employing a many-server (or Halfin-Whitt) approach to system design, we revisit the classic machine-repairmen-spares problem, which models a fleet of homogeneous breakdown-prone vehicles, a repair facility and replacement vehicles. Using large scale asymptotics, we approximate time-to-begin-repair and time-to-replacement performance metrics as functions of repair capacity and spare vehicle decision variables. The two-dimensional nature of our work distinguishes it from other many-server studies.

■ TB12

C-Room 26A, Upper Level

Network Flows

Sponsor: Computing Society
Sponsored Session

Chair: Eli Olinick, Associate Professor, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, olinick@engr.smu.edu

1 - Extreme-Point Search Heuristics for Interval-Flow Transshipment Networks
Richard Barr, Department Chair, Associate Professor, EMIS Department, Bobby B. Lyle School Engineering, Southern Methodist University, Dalllas, TX, 75275-0123, United States of America, barr@lyle.smu.edu, Robert Jones

Interval-flow network models allow minimum-flow requirements a solution's active arcs. While this characteristic is prevalent in practice, the resulting problems are NP-hard. Our adjacent extreme-point search heuristics quickly identifies high-quality solutions to large-scale problem instances. A computer implementation of this approach is tested on problems with up to 10,000 nodes and 100,000 arcs, giving solution speeds over 400 times faster than Cplex 10.

2 - Formulation of Mergers Among Oligopolistic Firms with Insights into the Merger Paradox
Anna Nagurney, John F. Smith Memorial Professor, UMass, Finance and Operations Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu

In this paper, we formulate network models of oligopolistic firms pre and post horizontal mergers as variational inequality problems. The flexibility of the computational approach, which yields closed form expressions at each iteration, allows us to gain deeper insights into the merger paradox.

3 - A New LP Formulation for the Maximum Concurrent Flow Problem
Eli Olinick, Associate Professor, EMIS Department, Bobby B. Lyle School Engineering, Southern Methodist University, Dallas, TX, 75275-0123, United States of America, olinick@lyle.smu.edu, David Matula, Jason T. Kratz

The MCFP is a multicommodity flow problem in a congested network where the objective is to maximize the ratio of the flow supplied between a pair of vertices to the predefined demand for that pair. For practical applications, MCFP gives rise to difficult-to-solve LPs and so the problem has received considerable attentionin the literature. We present a new formulation that yields significantly smaller LPs for the MCPF than the traditional arc-path or node-arc formulations.

■ TB13

C-Room 26B, Upper Level

Panel Discussion: COIN-OR Technology Forum

Sponsor: Computing Society
Sponsored Session

Chair: Matthew Saltzman, Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States of America, mjs@clemson.edu

1 - COIN-OR Technology Forum
Moderator: Matthew Saltzman, Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States of America, mjs@clemson.edu, Panelists: Lou Hafer, Robin Lougee-Heimer, Bjarni Kristjansson, Kipp Martin, Ted Ralphs

Attend the COIN-OR Technology Forum to meet COIN-OR project managers and board members, hear about recent developments in COIN-OR projects and future plans, contribute your ideas, or volunteer your time and skills to help make COIN-OR a better source of open-source software tools for operations research.

■ TB14

C-Room 27A, Upper Level

Optimization in Practice IV - Software

Sponsor: Computing Society
Sponsored Session

Chair: Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Optimization in Strategic Business Planning
Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Applying optimization techniques to strategic business planning can provide benefits that are potentially far greater than those realized by optimizing routine business operations. Quite simply, doing the right thing is far more important than doing the wrong thing well. We discuss the lessons learned in Vanguard's development of a forecasting and stochastic optimization solution that Novartis Vaccines & Diagnostics uses to optimize its drug investment activities.

2 - Efficient Optimization with Portfolio Safeguard Software
Stan Uryasev, University of Florida, Department of Industrial and Systems Engineer, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, uryasev@ufl.edu

We will present several case studies mostly in financial optimization area conducted using Portfolio Safeguard optimization software. Case studies will cover the following topics: portfolio optimization and portfolio hedging with downside risk measures such as VaR, CVaR, Drawdown, and others.

3 - Valid Inequalities for an Integer Programming Model for Software Projects with Soft Deadlines
Ishwar Murthy, Professor, Indian Institute of Management, Bannerghatta Road, Bangalore, 560076, India, ishwar@IIMB.ERNET.IN, Kaushik Dutta, Sridhar Narasimhan

We develop an integer programming model that enables software development companies manage software engineers (in-house and vendors) at their disposal to complete their projects with minimal violation of the project deadlines. The manpower requirement as well as the skill sets required for each project in each time period is known. The above NP-Hard problem is modeled as a multi-commodity path problem on an acyclic graph, with side constraints.

4 - OptForce™ Strategic Workforce Planning Technology: Combining Simulation and Optimization
Jay April, Chief Development Officer, OptTek Systems, Inc., 1919 Seventh Street, Boulder, CO, 80302, United States of America, april@opttek.com, James Kelly, Marco Better, Fred Glover

This presentation describes simulation optimization software technology being developed under a National Science Foundation SBIR contract to be used to enhance strategic workforce planning and management. The software combines two innovative methods drawn from the field of operations research: agent-based simulation and metaheuristic optimization. The software, which is called OptForceô, is used to evaluate decisions for creating, modifying, and eliminating workforce policies and programs.

■ TB15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Imagine That - ExtendSim-Power Tools for Simulation
Dave Krahl, Imagine That, Inc., 6830 Via Del Oro, Suite 230, San Jose, CA, 95119, davek@extendsim.com

See how quickly you can build robust, intuitive models with the power tool for simulation - ExtendSim. Revolutionary new simulation technology and 3D animation in ExtendSim is paired with core ExtendSim features such as hierarchical model building, user interface creation, and interactive modeling to make it the tool to watch in the simulation industry. Don't miss this demo!

2 - AIMMS (Paragon) - Monte Carlo Simulation Versus Stochastic Optimization
Peter Nieuwesteeg, Senior AIMMS Specialist, AIMMS (Paragon Decision Technology), 5400 Carillon Point, Kirkland, WA, 98033, United States of America, p.nieuwesteeg@aimms.com, Deanne Zhang

There are different approaches to handle uncertainty in your model. In this presentation we will show two of them and how you can use them in AIMMS. We start with a short introduction in AIMMS, followed by the ability to generate different solutions using solution pools and evaluating those solutions using Monte Carlo simulation. This will be followed by a demonstration of the stochastic programming feature in AIMMS. Customer examples will be used to demonstrate some of the features.

■ TB16

C-Room 28A, Upper Level

Personalization and Privacy

Sponsor: Information Systems
Sponsored Session

Chair: Shivendu Shivendu, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, Room # SB 426, Irvine, CA, 92697, United States of America, sshivend@exchange.uci.edu

1 - Resolving Personalization-Privacy Dilemma: A Privacy-Preserving Contract for Online Personalization
Jia Jia, Doctoral Student, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, China, jiajia1015@gmail.com, Raymond G. Sin

We design a privacy-preserving contract for online personalized services, and find that even in the absence of external instruments, the online vendor can derive an incentive-compatible contract that serves the entire market. Within this framework, we further investigate how the optimal contract would change if the government enforced a 'minimum-privacy-protection' policy, and identify the optimal level of such a threshold that maximizes the social welfare from the policy maker's perspective.

2 - Enabling Websites to Respect Privacy Norms and Preferences in Web Personalization
Alfred Kobsa, Professor, University of California, Irvine, Department of Informatics, Irvine, CA, United States of America, kobsa@uci.edu, Yang Wang

Internationally operating personalized website are often obliged to cater to different national privacy laws. They also need to take users' individual privacy preferences and industry self-regulation into account. We present a dynamic privacy-enhancing personalization framework that selects personalization methods during runtime in such a way that prevailing privacy constraints are being respected. We show that our approach is scalable to even the largest current websites.

3 - Economics of Software as a Service under Security Concerns
Shivendu Shivendu, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, Room # SB 426, Irvine, CA, 92697, United States of America, sshivend@exchange.uci.edu

Software as a Service (SaaS) is an overarching term for software delivery as a shared online service, and often includes on-demand applications and infrastructure. While users are increasingly getting attracted to this radically different way of software delivery and consumption, concerns regarding data security persist. In this paper we examine a firm's pricing strategies for on-line delivery of software as a service in a market with users that have heterogeneous concerns for data security.

■ TB17

C-Room 28B, Upper Level

Applications of Two-sided Markets

Sponsor: e-Business
Sponsored Session

Chair: Olivier Rubel, UC Davis, One Shields Avenue, Davis, CA, United States of America, orubel@ucdavis.edu

1 - Benchmarking Media-platforms: A Method and Application to Daily Newspapers
Shrihari Sridhar, Assistant Professor of Marketing, Michigan State University, 370 N. Business Complex, East Lansing, MI, 48824, United States of America, sswcb@mizzou.edu, Esther Thorson, Murali Mantrala, Prasad Naik

Our focus is benchmarking in the media industry.Media-firms' two-sided business model presents three challenges. We combine Network DEA and Multivariate Sliced Inverse Regression in a fashion that tackles these challenges.Our proposed approach is general and can be used in benchmarking other (non-media) two-sided platforms.Using data on U.S. print newspaper firms, we demonstrate how the proposed approach outperforms applications of the existing approaches applied to platforms.

2 - Hybrid Advertising Auctions
Yi Zhu, University of Southern California, 3660 Trousdale Parkway, ACC 306E, Department of Marketing, USC, Los Angeles, CA, 90089, United States of America, zhuy@usc.edu, Kenneth Wilbur

Several major websites offer hybrid auctions that allow advertisers to bid on a per-impression or a per-click basis for the same advertising space. The conventional wisdom is that brand advertisers (e.g. Coca-Cola) will bid per impression, while direct response advertisers (e.g. Amazon.com) will bid per click. We analyze a theoretical model of advertiser bidding to ask whether this conventional wisdom will hold up in equilibrium.

3 - Optimal Fundraising for a Charity
Olivier Rubel, UC Davis, One Shields Avenue, Davis, CA, United States of America, orubel@ucdavis.edu

I propose a dynamic model to investigate what should be for a charity, the optimal budget allocation between fundraising and program services. The state variable is the level of donation at time t, which growth is stimulated by the fundraising effort of the organization and the observed effort in program services. I investigate the dynamic consequences of such situation and explore various elements with respect to the management of charities.

■ TB18

C-Room 28C, Upper Level

Resiliency in Telecommunication Systems

Sponsor: Telecommunications
Sponsored Session

Chair: Jose Ramirez-Marquez, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, United States of America, Jose.Ramirez-Marquez@stevens.edu

1 - Connectivity Management in Mobile Ad-Hoc Networks
Abdullah Konak, Associate Professor, Penn State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, auk3@psu.edu, Alice E. Smith, Orhan Dengiz

This paper proposes a dynamic mobile ad-hoc network (MANET) system to improve network connectivity by using controlled network nodes, called agents. Agents have predefined wireless communication capabilities similar to the other nodes in the MANET. However, their movements and thus their locations are dynamically determined to optimize network connectivity. A particle swarm optimization algorithm is used to choose optimal locations of the agents.

2 - Two-Terminal Reliability under the Asymptotic Random Waypoint Spatial Distribution
Binchao Chen, Texas Tech University, 3102 4th St, Apt. 101, Lubbock, TX, 79415, United States of America, binchao.chen@gmail.com, aaron phillips, Timothy Matis

Estimating the two-terminal reliability of a mobile ad-hoc network (MAWN) is a critical measure in many applications, particularly those that are defense related. The spatial distribution of a MAWN under a random waypoint model is shown to have central tendency asymptotically. In this presentation, we demonstrate the method by which two-terminal reliability may be estimated in this case and provide numerical examples.

3 - Resiliency Techniques for Telecom Applications
Jose Ramirez-Marquez, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, United States of America, Jose.Ramirez-Marquez@stevens.edu

In many illegal activities networks are set up by the perpetrators to conduct their operations, such as smuggling goods, contraband, and people across borders or ports. To potentially interdict these networks in a successful and cost effective way, multi,Äêobjective evolutionary algorithms are being developed to overcome issues of current techniques. This presentation will discuss how network interdiction can be used to describe metrics such as vulnerability, resiliency and restoration response.

4 - Reliability for Defense Systems of Systems and Network Centric Systems
Jason Cook, US Army ARDEC, Bldg 62N, Picatinny, NJ, 07869, United States of America, jason.cook1@us.army.mil

Adoption of IT in the defense industry means systems formally singular are now connected via networks. In the network centric paradigm, reliability is paramount. Here multi-state reliability is combined with the ad-hoc network reliability methods to measure the reliable performance of a SoS and its elements by considering network connectivity, the interactions of connected elements and the resultant capability.

■ TB19

C-Room 28D, Upper Level

Traffic Assignment Methods

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Laurie Garrow, Georgia Tech, 790 Atlantic Dr, Atlanta, 30332, United States of America, Laurie.Garrow@ce.gatech.edu

1 - A Dynamic Traffic Assignment Model for a Highly Congested Urban Network
Moshe Ben-Akiva, Massachusetts Institute of Technology, Cambridge, MA, United States of America, mba@mit.edu, Song Gao, Yang Wen, Zheng Wei

We present the calibration of DynaMIT-P for modeling the highly congested and complex traffic network in Beijing, China. All demand and supply inputs and parameters were calibrated simultaneously using sensor counts and floating car travel time data. Successful calibration was achieved with the Path-Size Logit route choice model, explicit representations of lane groups, and a modified treatment of acceptance capacities to account for the large number of short links in the network.

2 - Large Network Application of Bi-criterion Dynamic Traffic Assignment Model with Heterogeneous Users
Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Lan Jiang, Chung-Chen Lu

We discuss strategies for application of bi-criterion dynamic equilibrium models to large-scale regional networks to evaluate toll pricing proposals and other network improvements. Improvements in algorithm design and implementation are discussed and demonstrated using the Baltimore region network.

3 - Disequilibrium Importance Measure of Network Components and Braess Paradox
Henry Liu, Assistant Professor, Department of Civil Engineering, University of Minnesota, 500 Pillsbury Drive S.E., Minneapolis, MN, 55455, United States of America, henryliu@umn.edu, Xiaolei Guo

We propose an importance measure of network components from a disequilibrium perspective and show that an unimportant link from the traditional equilibrium viewpoint could be important from a disequilibrium perspective. We then provide simple and ordinary grid networks with regular BPR link cost functions such that Braess paradox occurs, which indicate that Braess paradox can occur in real transportation networks.

4 - On the Existence of System Optimal Pricing Strategies in the Heterogeneous Single Bottleneck Model
Satish Ukkusuri, satish.ukkusuri@gmail.com, Kien Doan, Gitakrishnan Ramadurai

The heterogeneous single bottleneck with pricing is formulated as a linear program with complementary constraints. The non-existence of optimal pricing schemes are is shown in both the homogenous and heterogeneous problems. Computational results to demonstrate the pricing schemes are shown. In addition, practical pricing schemes which can possible be implemented will be discussed.

■ TB20

C-Room 28E, Upper Level

Joint Session AAS/TSL: Air Traffic Flow Management Models

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Michael Ball, Robert H Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, mball@rhsmith.umd.edu

1 - Stochastic and Dynamic Algorithm for Planning Ground Delay Programs Under Uncertainty in Airport Capacity
Avijit Mukerjee, U.C. Santa Cruz, MS 210-8, NASA Ames, Moffett Field, CA, 94035, United States of America, itsavijit@gmail.com, Shon Grabbe, Mark Hansen

This paper presents an algorithm for dynamically assigning flight departure delays under probabilistic airport capacity. Trade-off analysis is performed between various efficiency and equity metrics. As a case study, the algorithm is applied to assign departure delays to flights scheduled to arrive at San Francisco International Airport under uncertainty in the clearance time of fog. Experiments indicate that the proposed algorithm delays could reduce delays up to 20% compared to current level.

2 - From Uncertainty in Individual Flight Events Predictions to Probabilistic Traffic Demand Predictions

Eugene Gilbo, U.S. Department of Transportation, 1200 New Jersey Ave. SE, Washington, DC, 20590, United States of America eugene.gilbo@dot.gov, Scott Smith

An important element of NextGen program is probabilistic traffic flow management. The paper presents a method for the probabilistic representation of aggregate traffic demand predictions through consideration of the uncertainty in predictions of estimated time of arrival (ETA) for individual flights. It uses historical data from the existing Traffic Flow Management System to illustrate the differences between probabilistic and deterministic predictions.

3 - Geometric Recourse Model for Optimal Route Generation

Yoonjin Yoon, UC Berkeley, 107D McLaughlin Hall, Berkeley, CA, 94720, United States of America, yoonjin@berkeley.edu, Mark Hansen, Michael Ball

We study a probabilistic air traffic management strategy to reduce weather related delay. Geometric model is set up that with a recourse option to the destination if the weather clears en route. Analytic study identifies the condition of successful hedging and provides an analytic solution. Numerical study compares no-hedging, single and double recourse geometric models, leading to a conclusion that more responsive traffic control has larger impact in reducing delay.

4 - Preference Based Proportional Random Allocation of Enroute Resources

Nasim Vakili, University of Maryland, 3117 AVW Bldg, College Park, MD, 20742, United States of America, nasimv@umd.edu, Michael Ball

We describe new methods for the fair allocation of access to constrained enroute airspace. We propose a randomized procedure that will consider flight operators preferences over their flights. The new methods allow some flights to be refused access, since flight operators have the option of rerouting around the constrained airspace. Our procedure has potential usefulness both in airspace flow program planning and in the emerging System Enhancements for Versatile Electronic Negotiation.

■ TB21

C-Room 30B, Upper Level

Methods and Models for Road Pricing III

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu

Co-Chair: Siriphong Lawphonganich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611-6595, United States of America, lawphong@ise.ufl.edu

1 - Solving Path-based System-optimal Dynamic Traffic Assignment via Path Marginal Cost

Zhen (Sean) Qian, University of California Davis, Institute of Transportation Studies, University of California Davis, Davis, CA, 95616, United States of America, zqian@ucdavis.edu, Michael Zhang, Wei Shen

The path marginal cost (PMC) is defined as the equivalent monetary cost of the total amount of congestion in the network caused by one additional vehicle. The knowledge of PMC is central to system-optimal dynamic traffic assignment. This research proposes an innovative approach to compute PMC approximately but efficiently for general networks. The correctness and efficiency is demonstrated by solving the marginal cost dynamic tolls for a synthetic network and SO-DTA in a real corridor network.

2 - Realization Probability of Traffic User Equilibrium and Its Implications to Congestion Pricing

Xuegang (Jeff) Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St, JEC 4034, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu

In case the user equilibrium solution is not unique, we define the realization probability of a traffic equilibrium solution as the probability of realizing the solution given the distribution of the initial traffic system state. We illustrate how the realization probability can be calculated by assuming the day to day route choice adjustment process. Studying such a probability may have important implications to network design and congestion pricing applications.

3 - Differentiated Vehicle Mileage Fees: Incorporating Welfare, Revenue and Environmental Considerations

Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu, B. Starr McMullen

Fixed vehicle mileage fees encourage the ownership and use of fuel inefficient vehicles. This paper employs several methodologies to assess environmentally-friendly variable distance-based user charges. Results show that the welfare and revenue impact is sensitive to policy design. Models ignoring behavioral responses overestimate revenue changes by 11~28%. The most important behavioral responses are short-run adjustments unrelated to vehicle ownership decisions.

4 - Optimal Deployment of High-Occupancy Vehicle/Toll Lanes in General Networks

Ziqi Song, University of Florida, Department of Civil and Coastal Engineering, Gainesville, FL, 32608, United States of America, ziqi@ufl.edu, Siriphong Lawphonganich, Yafeng Yin

This paper investigates how to deploy high-occupy vehicle/toll (HOV/HOT) lanes in general networks. A mathematical program with complementarity constraints is formulated and solved to simultaneously determine the locations of HOV or HOT lanes and the toll rates on HOT lanes to maximize the social benefit. Numerical examples using networks in the literature are presented to verify the model.

■ TB22

C-Room 30C, Upper Level

Risk Management in Supply Chains I

Contributed Session

Chair: Jun-Yeon Lee, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, leej@uhv.edu

1 - A Multi-product Risk-averse Newsvendor under Coherent Risk Measures

Sungyong Choi, PhD Candidate, Rutgers Business School, 180 University Avenue, PhD Program in Management, Newark, NJ, 07102, United States of America, sungyongchoi@gmail.com, Andrzej Ruszczynski, Yao Zhao

We consider a multi-product risk-averse newsvendor under coherent risk measures. We first establish the convexity in the model. Then we derive the impact of risk aversion, asymptotic behavior and closed-form approximations of the optimal order quantities with independent demands. The approximations are as simple as to compute as the classical newsvendor model. For dependent demands case, we study the impact of demand correlation. These analytical results are confirmed by our numerical study.

2 - Dynamic Inventory and Financial Hedging Decisions for Storable Commodities

Zhan Pang, Research Associate, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, zhan.pang@utoronto.ca, Panos Kouvelis, Qing Ding

We address the problem of dynamic joint inventory and financial hedging decisions of a storable commodity for a risk-averse firm. In mean-variance framework, we show that the state-dependent base-stock policy is optimal for inventory control. We also show how to construct an optimal dynamic hedging strategy and explore the impact of financial hedges on dynamic inventory policy.

3 - Information Security in Supply Chain Networks

Harpreet Singh, UCONN, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, harpreet.singh@business.uconn.edu, Manuel Nunez, Jose Cruz

Firms often face situations in which there is a need to disclose confidential or strategic information to suppliers, thus increasing their risk of disclosing sensitive information to suppliers and also to competitors connected to suppliers in the supply chain network. In this paper, we create a mathematical model which relates disclosure risk to supply chain network topology, and thus help retailers to assess risk and return of doing business with a supplier embedded in a supply chain network.

4 - Group Decision Support System to Assess Inbound Supply Risk

Rajesh Hadavale, Grosscurth Fellow, University of Louisville, S 2nd Street, Louisville, KY, 40208, United States of America, rajesh.hadavale@gmail.com, Suraj Alexander

It is critical to assess Inbound Supply Risk to ensure uninterrupted supply of the necessary components and services. In this context we propose a group decision support system that provides a framework to identify, classify, and access inbound supply risk. The proposed model considers risk as time dependent and periodically gets Intensity preferences from group of decision maker that are aggregated to estimate the level of risk.

5 - Supply Chain Collaboration with Vendor-managed Inventory under Exchange Rate Uncertainty

Jun-Yeon Lee, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, leej@uhv.edu

VMI (Vendor-Managed Inventory) is a well-known industry practice for supply chain collaboration. In this paper we study supply chain collaboration with VMI in a global environment, in which the manufacturer and the supplier face

exchange rate uncertainty. In particular, we examine what is the optimal VMI contract for the manufacturer and what is the optimal inventory policy for the supplier under the VMI contract and exchange rate uncertainty.

■ TB23

C-Room 30D, Upper Level

Applications of Optimization to Operations at the US Air Force Academy

Sponsor: Military Applications Society
Sponsored Session

Chair: Andrew Armacost, Professor and Department Head, US Air Force Academy, Dept of Management, 2354 Fairchild Drive, Suite 6H122, USAF Academy, CO, 80840, United States of America, andrew.armacost@usafa.edu

1 - USAF Academy OR Capstone Course & Project Outgrowth

Maureen Borgia, Asst Professor, USAF Academy, Department of Management, 2354 Fairchild Dr, Ste 6H-130, USAF Academy, CO, 80132, United States of America, maureen.borgia@usafa.edu, James Lowe, Andrew Armacost

The US Air Force Academy OR major concludes with a 2-semester capstone course sequence during which senior cadets solve a real-world problem. Problems are solicited from organizations including the USAF Academy, US Air Force, Department of Defense, local government, and local non-profit groups. A number of projects have solved various scheduling and matching issues for the USAF Academy. The outgrowth of these projects continue to be used by the USAF Academy and are maintained by faculty.

2 - Summer Seminar Scheduling at AFA

James Lowe, Professor of Operations Research, US Air Force Academy, Department of Management, 2354 Fairchild Drive, Suite 6H-130, USAF Academy, CO, 80840, United States of America, jim.lowe@usafa.edu

The Air Force Academy Summer Seminar allows high school students to observe, learn, and enjoy the Colorado summer. Over 3300 Students select from 25 different academic programs offered. Historically, students were placed into academic programs on a first-come, first-serve basis. We created a more efficient method of assigning students. In 2009, all 3300 students received at least one of their top 3 choices. We discuss the XPRESS optimization Excel spreadsheets developed to assist staff.

3 - Optimization of the Cadet Military Performance Appraisal Process at USAFA

Mark Parker, Associate Professor, Carroll College, Department of Math, Engineering, and CS, 1601 N. Benton Avenue, Helena, MT, 59625, United States of America, mparker.math@gmail.com, James Lowe

In order to provide more diverse input to cadet military performance, USAFA revamped their Military Performance Appraisal (MPA) system during the 2008-9 academic year. The goal was to have 3 faculty members, up to 10 subordinates, and up to 5 peers rate each cadet. We discuss the XPRESS optimization developed for the faculty/cadet assignment and the Excel spreadsheets developed for the peer-to-peer and subordinate-to-supervisor assignments.

4 - Scheduling AF Academy Summer Operations Tours

Andrew Armacost, Professor and Department Head, US Air Force Academy, Dept of Management, 2354 Fairchild Drive, Suite 6H122, USAF Academy, CO, 80840, United States of America, andrew.armacost@usafa.edu, Mark Parker, Nick Hainsfurther, James Lowe

Each AF Academy student is required to spend between one and three summers at an active Air Force base. We develop an optimization model to match more than 3,000 students to these operations tours, considering capacity constraints at each base, requirements for each cadet to visit bases with different missions, and to have each cadet visit bases in various geographic areas. We discuss the model's implementation using Xpress-MP and the impact this model has had on the Air Force Academy.

■ TB24

C-Room 30E, Upper Level

OM Models of Strategic Customers, Customer Learning

Cluster: Economic Models in Operations Management
Invited Session

Chair: Brian Tomlin, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States of America, brian.tomlin@tuck.dartmouth.edu

Co-Chair: Ali K. ParlakturkAssistant Professor, UNC Kenan-Flagler Business School, McColl Bldg S4708, Campus Box 3490, Chapel Hill, NC, 27599, United States of America, Ali_Parlakturk@unc.edu

1 - Estimation, Pricing, and Strategic Customer Behavior

Adam Mersereau, Asst. Professor, University of North Carolina, Kenan-Flagler Business School, CB #3490, Chapel Hill, NC, 27599-3490, United States of America, ajm@unc.edu, Dan Zhang

A growing segment of the revenue management and pricing literature assumes "strategic" customers who are forward-looking in their pursuit of utility. Recognizing that such behavior may not be directly observable, we examine the implications in a markdown pricing setting of seller uncertainty around the proportion of customers behaving strategically. We prove revenue bounds for single-season problems, and we examine multi-season versions where the seller estimates demand based on observations.

2 - Risk Pooling with Strategic Customers

Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, swinney_robert@gsb.stanford.edu

We investigate the value of various risk pooling strategies when a firm sells to strategic, or forward-looking, customers. Such customers anticipate future changes in price and product availability, and may take this information into account when making their own purchasing decisions. We consider the impact of this behavior on the value of risk pooling both for a single firm and for a supply chain.

3 - Signaling Service Quality in Queues

Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu

We study how a high quality service firm signals quality to differentiate from a low quality service firm under congestion prone environments. Rational consumers join queues based on signaling efforts of the firms, congestion in the market, and the service value. We show that it is likely high quality firms may incur lower revenues due to signaling efforts.

4 - The Value of Product Variety When Dealing with Strategic Customers

Ali K. Parlakturk, Assistant Professor, UNC Kenan-Flagler Business School, McColl Bldg S4708, Campus Box 3490, Chapel Hill, NC, 27599, United States of America, Ali_Parlakturk@unc.edu

We consider a firm that sells two vertically (quality) differentiated products to strategic consumers over two periods setting the prices dynamically in each period. The consumers are heterogeneous in their evaluations of quality and they are strategic in that they decide not only whether and which product variant to buy, but also when to buy choosing the option that maximizes their utility. We derive the equilibrium of the pricing-purchasing game between the firm and the consumers.

■ TB25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Cost of Airline Delays, Cancellations, and Capacity Constraints

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Mark Hansen, UC Berkeley, 114 McLaughlin Hall, University of California, Berkeley, CA, 94720, United States of America, mhansen@ce.berkeley.edu

1 - Costs to Businesses of Air Travel Delays

Kevin Neels, Principal, The Brattle Group, 44 Brattle Street, Cambridge, MA, 02138, United States of America, Kevin.Neels@brattle.com

This presentation will examine the costs that air travel delays impose on businesses. It will consider how increased travel time and decreased reliability affects costs and performance. Finally, the presentation will explore some of the strategies businesses have adopted to cope with the uncertanties of air travel, including both changes in traveler behavior, and substitition of non-travel alternatives.

2 - Estimating the Impact of Airport Capacity Constraints on the Number and Timing of Scheduled Flights

Prem Swaroop, University of Maryland, College Park, MD, pswaroop@rhsmith.umd.edu, Mark Hansen, Michael Ball

Airport capacity constraints impact airline scheduling behavior in a variety of ways. These include 1) scheduling fewer flights, 2) scheduling flights at less desirable times and 3) moving service to "secondary" airports. We present a combination of statistical and optimization methods that quantify the extent of these effects. Our results allow the estimation of the economic impact of capacity constraints as they pertain to schedule changes.

3 - Evaluating the Economic Impact of NAS Performance on Airline Operations-an Econometric Approach

Bo Zou, Mr., National Center of Excellence for Aviation Operations Research, 109 McLaughlin Hall, UC Berkeley, Berkeley, CA, 94720, United States of America, bzou@berkeley.edu, Mark Hansen

This paper examines the impact of NAS performance on airline operations by estimating cost functions that include NAS performance as new arguments. The development of performance measures is based on factor analysis of metrics developed and a priori consideration. Results reveal delays, cancellation and scheduling padding present significant impacts. Using the estimated cost models, we predict airline costs associated with current NAS performance reach a magnitude of 10 billion dollars.

■ TB26

C-Room 31B, Upper Level

Stochastic Optimization I

Contributed Session

Chair: Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu

1 - Definition of Maintenance Policies Applying Stochastic Optimization

Carlos Osorio-Ramirez, Politecnico Grancolombiano, Calle 57 3 00 Este Fac. Ingenieria, Bogota, Colombia, caosorio@poligran.edu.co, Javier Nieto, Jesus Velasquez

This paper presents a non-anticipative stochastic optimization model in order to determine the most common maintenance decisions, according to a set of possible scenarios with some feasible sequences of failures.

2 - Computational Experience of Solving Two-stage Stochastic Linear Programming Problems

Viktar Zviarovich, PhD Student, CARISMA, Brunel University, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom, viktar.zviarovich@brunel.ac.uk, Csaba Fabian, Francis Ellison, Gautam Mitra

We present a computational study of two-stage SP solution algorithms for a range of benchmark problems. We consider application of (1) Simplex method and (2) IPM to solve deterministic equivalent problems, (3) Benders decomposition, (4) stochastic decomposition and (5) three regularisation methods. The first method is an experimental heuristic regularisation. The last two are based on the level decomposition by Fabian and Szoke. The scale-up properties and the performance profiles are presented.

3 - A Stochastic Inventory Model for Critical Spare Parts Used for Maintenance of Construction Machines

Nihat Kasap, Assistant Professor, Sabanci University, Faculty of Management, Istanbul, 34956, Turkey, nihatk@sabanciUniversityedu, Ilker Bicer

We develop a stochastic inventory model for critical spare parts used for the maintenance of heavy construction machines. Proposed model is a nonlinear integer optimization problem with average service level and replenishment frequency constraints. The aim of the model is to find out reorder points and stocking levels of critical spare parts that minimize the inventory costs. We propose heuristic that contains modified ABC Analysis and can be implemented with the spreadsheet applications easily.

4 - Progressive Hedging Applied to Stochastic Forestry Planning Problem

Fernando Badilla Veliz, Master in OR thesist, Universidad de Chile, Beauchef 850, Santiago, Manuel de Salas 35, depto. 151, – Uñoa, Santiago, Chile, fbadilla@ing.uchile.cl, David Woodruff, Andres Weintraub, Roger Wets

The problem consist in planning the optimal harvest, deciding when and which lots to harvest, roads to build (binary decisions) and the wood flow through these roads; under different†probabilistic price, demand and yield scenarios. We present an approach to solve this integer stochastic problem†which handles the non anticipativity constraints based on the heuristic progressive hedging, decomposing the problem so that it's not limited by the number of scenarios considered.

5 - A Recursive Decomposition Algorithm for Generating p-Efficient Points

Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu, Elise Miller-Hooks

p-efficient points are employed in solving programs with joint chance constraints where the random vector is discrete. Generating these points is problematic when the number of dimensions or domain of the random vector is large. A new recursive decomposition algorithm is proposed that restricts the search to sub-domains that contain the p-frontier thereby reducing the computation and memory requirements.

■ TB27

C-Room 31C, Upper Level

Uncertainty Modeling and Simulation

Sponsor: INFORMS Simulation

Sponsored Session

Chair: Elmira Popova, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States of America, elmira@mail.utexas.edu

1 - Preventive Maintenance Optimization Using Non-parametric Methods

Dmitriy Belyi, The University of Texas at Austin, United States of America, all_hail_dima@hotmail.com

This paper focuses on the problem of finding the minimal-cost preventive maintenance schedule for a single item. We model the problem using the failure rate of the item, and develop an efficient optimization algorithm under typical conditions on the failure rate. If the failure rate is unknown, we employ a Gibbs sampling algorithm to simulate from the failure rate using real data. We then analyze the effectiveness of this approach on some generated and real data sets.

2 - Sustainability Toolkit for Simulation-Based Logistics Decisions

Michael Kuhl, Associate Professor, Rochester Institute of Technology, Industrial & Systems Engineering Department, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, mekeie@rit.edu, Xi Zhou

As sustainability issues are becoming an integrated part of operational and long-term decisions, simulation tools are needed to aid in the decision-making process. We introduce the concept of a simulation-based sustainability toolkit and present a prototype of one portion of the toolkit for simulating sustainability aspects of logistics systems. The toolkit enables decision-makers to have sustainability measures as readily available as traditional productivity performance measures.

3 - Random Environment Models for Software Reliability

Refik Soyer, George Washington University, 2201 G Street NW, Funger Hall 415, School of Business, Washington, DC, 20052, United States of America, soyer@gwu.edu

We consider reliability assessment of a software system which is subject to a dynamic operating environment. In so doing, we discuss hidden Markov models as well as other modulating processes for describing dynamics of the environment. We develop Bayesian inference for these models.

4 - Simulating Cointegrated Time Series

Elmira Popova, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States of America, elmira@mail.utexas.edu, Ivilina Popova, Alexander Galenko

We present new theoretical results for cointegrated time series. They allow us to create a special input for the Vector AustoRegresive To Anything (VARTA) algorithm such that the cointegration property is preserved. We illustrate the procedure with four financial time series.

■ TB28

H-Room 500, Fifth Floor

Revenue Management in Online Advertising

Sponsor: Revenue Management and Pricing

Sponsored Session

Chair: Tammy Wang, St. Market Research Manager, Microsoft Corp., One Microsoft Way, Redmond, WA, United States of America, yiwa@microsoft.com

1 - Revenue Management in Online Advertising: Challenges and Opportunities

Aaron Easterly, General Manager, Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052, United States of America, aeast@microsoft.com

The scale of transactions and data in online advertising exercises and challenges revenue management theories. The complexity and dynamic nature of the data pushes the limits of research. Improvements in revenue management methods can be deployed rapidly and result in many millions of dollars in incremental revenue. This session will discuss current, real-world challenges in the search and display advertising domains, and provide insight into how this space is evolving to meet new demands.

2 - An Empirical Model of Search Advertising Auctions
Susan Athey, Professor, Harvard University, athey@fas.harvard.edu

We introduce a model of bidding behavior in sponsored search advertising markets incorporating the fact that in practice, bids are fixed for a period of time, during which many features of the environment change, including the set of opposing bidders and the system's quality scores used for ranking bids. We use historical data from a search engine to generate estimates of bidder valuations. We compute counterfactual equilibria to evaluate the auction design.

3 - Exploring the Long Tail in Paid Search Advertising
Randolph Bucklin, Peter W. Mullin Professor, University of California, Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90266, United States of America, randy.bucklin@anderson.ucla.edu

We explore the phenomenon of the "long tail" in an advertiser's list of keywords in paid search campaigns. While a small proportion of keywords will account for most user activity (i.e., searches, clickthroughs, purchase transactions) those in the tail may be quite attractive. We empirically examine the question how keywords in the long tail perform for advertisers relative to the more popular ones.

4 - Yield Optimization in Display Ad Networks
Peng Han, Sr. Research Manager, Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052, United States of America, penha@microsoft.com

A display ad network is a middleman between online publishers, the supply side, and online advertisers, the demand side. It buys inventory (impressions) from the publishers, resells them to the advertisers, and profits from the price differences. This paper talks about the application of optimization in Microsoft Media Network (MMN), and the modeling/solving techniques to meet the performance requirement.

■ TB29

H-Room 501, Fifth Floor

Energy Model and Methods

Sponsor: Energy, Natural Res & the Environment/Energy Sponsored Session

Chair: Steven Gabriel, Dr., University of Maryland, 1143 Martin Hall, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, sgabriel@umd.edu

1 - Pricing of Binary Variables in Energy Market Equilibrium Models
David Fuller, UWaterloo, 200 University Ave, Waterloo, Canada, dfuller@engmail.uwaterloo.ca

In market equilibrium models with only continuous variables, prices are usually extracted as dual variables of constraints. However, many models require some binary variables – on/off decisions in short term models, or build/don't build decisions in long term capacity planning models. There is no established way to define prices of discrete activities, so equilibrium is difficult to define. I present a two-part pricing approach to resolve some difficulties. Applications will be suggested.

2 - Coordinating Biofuels Policies: Can We Meet Multiple Standards?
Elena Safirova, Dr., Resources for the Future, 1616 P Street, NW, Washington, DC, Safirova@rff.org, Steven Gabriel, Shalini Vajjhala

We develop a prototype biofuels model focused on major cross-sectoral interactions. This is a multi-market model of economic activity with a focus on three economic sectors: electricity, transportation, and agriculture – and calibrated for the US economy. Using the model, we conduct an analysis of the interactions between policies designed to impact individual sectors and the impacts of those policies on food production, energy and environment, infrastructure, and economy at large.

3 - Biding Strategy of a Producer with Endogenous Formation of LMPs
Antonio J. Conejo, Professor, University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, antonio.conejo@uclm.es, Carlos Ruiz

This presentation considers a producer that trades electric energy in a pool, and provides a procedure to derive its optimal offering strategy considering uncertainty on both demand bids and production offers of rival producers. The proposed procedure relies on a bilevel programming model whose upper-level problem represents the profit maximization of the strategic producer while the lower-level one represents the market clearing and the corresponding price formation.

4 - Analysis of the North American Natural Gas Market Using the World Gas Model
Steven Gabriel, Dr., University of Maryland, 1143 Martin Hall, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, sgabriel@umd.edu, Ruud Egging

We provide an analysis of the North American natural gas market and by extension, impacts on Europe. We make use of the World Gas Model (WGM), a large-scale complementarity model of global gas markets in which some of the players are depicted as Nash-Cournot agents. We consider a variety of supply scenarios including: gas from Alaska, additional shale production, LNG imports and competition in the Atlantic and Pacific basins as part of our overall analysis.

■ TB30

H-Room 502, Fifth Floor

Open Pit Mine Planning, II

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 - Applying a Sliding Time Window Heuristic to the Open Pit Mine Block Sequencing Problem
Kelly Eurek, Graduate Student, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, keurek@mines.edu, Alexandra Newman

Using a standard integer programming formulation for the open pit mining block sequencing problem, we demonstrate the use of a sliding time window heuristic to solve a real problem instance containing tens of thousands of blocks and 20 time periods. We compare the performance of this heuristic to a standard multi-period heuristic and discuss the extent to which the resulting schedules helped management form decisions for this mine in Latin America.

2 - Short Term Mine Planning Model Supporting Geometallurgical Blending
Enrique Rubio, Universidad de Chile, Beauchef 850, Santiago, Chile, erubio@redcoglobal.com, Camilo Morales

We propose an integer programming model to determine a short term mine planning model maximizing the total fines production over 6 months subject to dynamic geometallurgical blending constraints. The proposed model has been tested at Spence mine (in which a sequential oxide, sulfide ore campaign is performed) and has been used at mine scale as guide for short term mine planners to define the best block sequencing for 6 month time periods.

3 - Risk Control in Ultimate Pits Using Conditional Simulations
Juan Pablo Vielma, ISyE, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, jvielma@isye.gatech.edu, Daniel Espinoza, Eduardo Moreno

We study how to incorporate risk control to the generation of ultimate pits when orebodies are are modeled through a finite number of conditional simulations. We consider several risk measures and incorporate them into the generation of ultimate pits by solving a stochastic programming version of the ultimate pit problem. We also study the effect of using different number of simulations in the generation and evaluation of ultimate pits.

■ TB31

H-Room 503, Fifth Floor

Decentralized Revenue Management

Sponsor: Revenue Management and Pricing Sponsored Session

Chair: Andrew Lim, Associate Professor, University of California (Berkeley), IEOR Department, 4177 Etcheverry Hall, University of California, Berkeley, CA, 94720-1777, United States of America, lim@ieor.berkeley.edu

1 - On a Collaborative Mechanism Based on Exchange Prices in Multicommodity Flow Networks
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu, Luyi Gui

In a multicommodity network where edge capacities and commodities are privately owned, we design a collaborative mechanism based on capacity exchange prices so as to subtly regulate the selfish behaviours of the players. We study the stability and efficiency of such price mechanisms and the fairness of the resulting payoff allocations in terms of cooperative game theory. We also consider the robustness of the mechanism by characterizing the system equilibria under data uncertainties.

2 - A Bilevel Stochastic Programming Model for Medium-term Trading for Retailers in Electricity Markets

Miguel Carrion, Dr., University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, Miguel.Carrion@uclm.es

We present a bilevel programming approach to formulate the medium-term decision-making problem faced by a power retailer. A retailer must decide its level of involvement in the futures market and the selling price offered to its potential clients. The objective of this retailer is to maximize the expected profit at a given risk level. A stochastic programming model is proposed in order to account for the uncertainty on future pool prices, client demands, and rival-retailer. Unlike previous approaches, client response to retail price and competition among rival retailers are explicitly considered in the proposed bilevel model. A realistic case study is solved to illustrate the efficient performance of the methodology proposed.

3 - Assessing Network Access Charge for New Telecommunications Services: the Korean IPTV Case

Jungsuk Oh, Associate Professor, Seoul National University, College of Business Administration, 599 Gwanangno Gwanak-gu, Seoul, 151-916, Korea, Republic of, joh@snu.ac.kr, Jung Hyun Cha, Dong Hee Kim, Soo Wook Kim

The IPTV service has been heralded as the ultimate convergence service between media and telecommunications sectors. Despite musch expectations, the commercial launch was delayed due to various disagreements. One of the biggest issues was whether and at what price the network providers have to rent their backbone infrastructure out to IPTV service providers. In this paper, a framework and a methodology for assessing the amount of access charge are presented.

■ TB32

H-Room 504, Fifth Level

Financial Engineering Methods and Applications

Cluster: Financial Engineering
Invited Session

Chair: Vadim Linetsky, Professor, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, linetsky@iems.northwestern.edu

1 - Modeling Correlated Defaults

Rafael Mendoza-Arriaga, Assitant Professor, The University of Texas at Austin, Information, Risk, & Operations Manageme, CBA 5.202, B6500. 1 University Station, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu, Vadim Linetsky

We present a novel framework for modeling correlated defaults where it is possible to capture the so-called "contagion effect". Time changing multi-parameter Markov processes with multivariate subordinators leads to jump-diffusion processes that are correlated through their jump measures. When unpredictable shocks arrive, the default intensity of multiple firms will shift simultaneously, which can trigger multiple defaults.

2 - Secured Asset Financing with Credit, Asset, and Foreclosure Risks

Steven Golbeck, PhD Student, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Rd, C210, Evanston, IL, 60208, United States of America, StevenGolbeck2008@u.northwestern.edu, Vadim Linetsky

Asset financing, such as residential and commercial real estate mortgages and heavy equipment loans and leases constitute a large and significant segment of the global debt markets. In a typical asset backed loan, the lender is exposed to the risk of default, the foreclosure risk, and the asset price risk. We develop secured asset financing models that take these risks into account.

3 - Commodity and Energy Models with Mean-reverting Jumps: A Spectral Expansion Approach

Lingfei Li, PhD student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, lingfeili2012@u.northwestern.edu, Vadim Linetsky

We construct a novel class of pure jump and jump-diffusion commodity and energy models with mean-reverting jumps by applying time changes to the classical commodity models based on mean-reverting diffusions. We obtain analytical solutions for pricing options on futures by applying the spectral expansion methodology. The models are flexible enough to capture a variety of implied volatility smile patterns observed in energy, metals, and agricultural commodities futures options.

4 - Bermudan Options Valuation in Levy Models

Liming Feng, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@uiuc.edu, Xiong Lin

In this talk, we present a transform based method for the pricing of Bermudan vanilla, barrier, and lookback options in Levy process models. Numerical results demonstrating exponential convergence of our method will be shown.

■ TB33

H-Room 505, Fifth Floor

Pricing and Inventory Issues in Product Variety Management

Cluster: Economic Models in Operations Management
Invited Session

Chair: Mehmet Gumus, Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, mehmet.gumus@mcgill.ca

1 - Assortment Planning When Consumers Have Heterogeneous Quality Preferences

Mark McElreath, PhD Student, Clemson University, 110 Freeman Hall, Clemson, SC, 29634-0920, United States of America, mmcelre@clemson.edu, Maria Mayorga

We consider the inventory management and assortment planning problems with multiple quality levels of products using a locational choice model. Customers have a heterogeneous preference for quality and are classified as either "price seekers" or "quality seekers". Our results characterize the properties of optimal assortments under these assumptions.

2 - Dynamic Pricing of Substitutable Products under Logit Demand

Minsuk Suh, UM, 1205 Beal Ave, Industrial and Operations Engineering, Ann Arbor, MI, 48109, United States of America, mssuh@umich.edu, Goker Aydin

We consider the problem of dynamically pricing two substitutable products over a finite selling season. Our model captures the effect of prices and stock-outs on customer choice. We prove monotonicity properties for the optimal price difference and the optimal purchase probabilities. We extend the results to a multi-segment problem, in which the segments differ from one another in terms of the product(s) they are considering. We study the benefits from price discriminating among the segments.

3 - Dynamic Assortment Customization with Limited Inventories

Lei Xie, PhD student, Duke University, 1st towerview, Durham, United States of America, lei.xie@duke.edu, Gurhan Kok, Fernando Bernstein

We consider a retailer with limited inventories of a category of substitutable products and heterogeneous customer preferences. Customers arrive sequentially and the firm decides which subset of the products to offer to a customer depending on the customer type, the inventory levels and the time-to-go in the season. We show that limiting the choice set of some customers can significantly increase profitability.

4 - Multi-Product Dynamic Pricing and Inventory Ordering Strategies

Mehmet Gumus, Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, mehmet.gumus@mcgill.ca

Product variety requires extensive coordination between supply and demand. To achieve this target, firms not only need to manage their prices and inventories jointly but also need to understand the impact of their pricing decisions on customers' purchase decisions in a multi-product environment. In this paper, we develop two demand models in order to capture strategic effects of product prices on purchase decisions.

■ TB34

H-Room 520, Fifth Floor

Transportation and Environmental/Societal Impact

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Theresa Barker, PhD Candidate, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@u.washington.edu

1 - Evaluating Emission Reductions and Trade-offs in Urban Pickup and Delivery Systems

Felipe Sandoval, University of Washington, 135 More Hall, Seattle, WA, United States of America, felipe7@u.washington.edu, Anne Goodchild

This research presents a novel routing and scheduling model that minimizes emissions from a heterogeneous fleet of pickup and delivery vehicles. The model has been developed to allow for study of the relationships and trade-offs between emissions, financial cost, and service quality. A specific case study which demonstrates application of the model will be presented. The model can be used to consider individual delivery fleets, and the impact of regulatory policies on these fleets.

2 - An Analysis of Train Emissions and Their Health Impacts in California's Alameda Corridor

Jean-Daniel Saphores, Associate Professor, University of California, Irvine, Civil and Environmental Engineering, Irvine, CA, 92697, United States of America, saphores@uci.edu, Rose Raymond, Stephen Ritchie, Mana Sangkapichai, Oladele Ogunseitan

The Alameda corridor is a key rail link for moving freight in and out of the Ports of Los Angeles and Long Beach but it contributes significantly to local air pollution. As a first step for understanding trade-offs between truck and rail freight transport, we analyze the emissions and the dispersion of PM and NOx emitted by train operations in the Alameda corridor, and present estimates of their health impacts. We then highlight data gaps and present difficulties encountered in our analyses.

3 - Microscopic Modeling of Air Quality Impacts of Drayage Truck Operations in the Alameda Corridor

Stephen Ritchie, Professor, University of California, Irvine, Civil and Environmental Engineering, Irvine, CA, 92697, United States of America, sritchie@uci.edu, Jean-Daniel Saphores, Mana Sangkapichai, Iris You, Gunwoo Lee, Robert Ayala

In this study we seek to develop and investigate 'microscopically-based' analysis tools that will shed light on the links between Ports of Long Beach and Los Angeles freight traffic, air pollution, and the health of local communities, and the effectiveness of alternatives to mitigate the environmental and health impacts of port activities. This presentation will discuss the results of this study to date and some of the difficulties in implementing microscopic approaches to this problem.

■ TB35

H-Sapphire A, Fourth Floor

Scheduling and Resource Allocation Applications in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu

1 - Optimal Capacity Planning for Medicaid Home and Community Based Services

Feng Lin, Weldon School of Biomedical Engineering, Purdue University, 206 S. Martin Jischke Drive, West Lafayette, IN, 47907-2032, United States of America, linf@purdue.edu, Mark Lawley, Nan Kong

An effective long-term care (LTC) provision and delivery system is critical to an aging society, especially when the payers are straining under serious financial burden. HCBS is considered as a partial solution to the expensive institutional services, but it cannot substitute institutional services completely. An optimization model is developed to determine the capacity of a HCBS program that minimizes the overall Medicaid expenditures, including expenditures of LTC services and acute care.

2 - Optimizing Provider Capacity Policies in Open Access Clinics by Considering Patient Choice

Xiuli Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, xqu@ncat.edu, Jing Shi

To improve the accessibility and reduce patient no-shows, many clinics are experimenting with open access scheduling. However, the implementations of open access scheduling prove far less successful than anticipated due to the lack of quantitative decision making tools. In this talk, we present a Markov chain model to capture open access scheduling process when considering patient choice. Using this model, we optimize provider capacity policies for a provider (team) in open access clinics.

3 - Stochastic Sequential Scheduling for Continuous Consultation Sessions with Customer No-show

Santanu Chakraborty, Purdue University, Champaign, IL, 61822, chakrabs@purdue.edu, Mark Lawley, Kumar Muthuraman

In this paper we develop a sequential scheduling algorithm for the case where the service period is not divided into slots. We assume that the service time distribution is exponential and each customer has a certain probability to no-show. We prove that the expected cost is a convex function of appointment time. Computational results show that the this method yields higher expected profit and less overtime compared to a situation where service period is divided into slots of standard length.

■ TB36

H-Sapphire B, Fourth Floor

Optimization in Radiotherapy III

Sponsor: Health Applications
Sponsored Session

Chair: Allen Holder, Rose-Hulman Inst. of Tech., 5500 Wabash Ave., Terre Haute, IN, 47803, United States of America, holder@rose-hulman.edu

1 - Dosimetry Robustness with Stochastic Optimization

Omid Nohadani, MIT, 77 Massachusetts Ave, E40, Cambridge, MA, 02139, United States of America, nohadani@mit.edu, Joao Seco, Thomas Bortfeld

All radiation therapy planning rely on dose calculation. Dosimetric and imaging uncertainties can degrade an otherwise optimal plan. We present a robust optimization method which handles dosimetric errors and warrants for high-quality Monte Carlo based IMRT plans. We demonstrate it on a clinical lung cancer case and show that the plans are more robust against errors and are clinically acceptable. They exhibit a two-fold improved equivalent uniform dose and a significant computational speed-up.

2 - Optimization Models for Leksell Gamma Knife Perfexion Treatment Planning

Hamid Ghaffari, University of Toronto, 5 King's Collage Road, Toronto, ON, M5S3G8, Canada, ghaffari@mie.utoronto.ca, David Jaffray, Dionne Aleman, Mark Ruschin

Stereotactic radiosurgery (coined Gamma Knife by Elekta) has been used to treat brain tumors and lesions for four decades. Perfexion is the newest generation of Elekta's Gamma Knife machines, and allows for the size and shape of each radiation shot to be dynamically changed, as well as for the position of the patient to be moved in three dimensions. We present an optimization model that fully incorporates the capabilities of Perfexion units. Performance results using test data are presented.

3 - Unifying Radiotherapy Design with Fourier Solutions

Allen Holder, Rose-Hulman Inst. of Tech., 5500 Wabash Ave., Terre Haute, IN, 47803, United States of America, holder@rose-hulman.edu, Vicky MaK

Optimizing radiotherapy treatments is traditionally segmented into three separate problems, but unified models are emerging due to advanced solution methods. We propose a simple, unified model and a solution method based on Fourier series. Such solutions innately limit treatment time and simultaneously satisfy dose limitations.

■ TB37

H-Sapphire C, Fourth Floor

Birthday Session for Warren Hausman and Bob Carlson

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Candi Yano, UC Berkeley, IEOR Department and Haas Sch. of Bus., Berkeley, CA, 94720, United States of America, yano@ieor.berkeley.edu

1 - OR and BI: Leveraging the Power of In-Database Analytics

Anne Robinson, Sr. Manager, Information and Data Strategy, Cisco, 170 West Tasman Drive, San Jose, CA, 95134, United States of America, annerobi@cisco.com, Blake Johnson

The complexity of Operations Research has traditionally limited its application to specialized problems or blackbox software. Recent advances to put predictive and optimization modeling capabilities within enterprise data warehouses (EDW) enables new avenues for OR analysts. By combining the power of the EDW, math models, and Business Intelligence (BI) technologies, OR can be applied and disseminated to a much broader audience in a more robust format, enabling true intelligence for the business.

2 - A Central Warehouse with a Dual Role in the Supply Chain

Kyle Cattani, Associate Professor, Kelley School of Business, Indiana University, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, kcattani@indiana.edu, F. Robert Jacobs, Jan Schoenfelder

Using data from a Midwest-based company, we evaluate the efficacy of traditional analytic models in terms of determining effective inventory policies for an arborescent supply chain where the central warehouse not only serves to replenish other warehouses, but also meets demand from nearby end customers. We find that traditional modeling assumptions of a strictly arborescent structure as well as the assumptions about demand distributions impede usefulness of traditional models.

3 - Supply Chain Finance: Issues, Models and Results
Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu

This presentation will provide a quick overview of recent research activity in better understanding issues of financing in capital constrained supply chains and their effects on inventories,retail ordering behavior, and overall supply chain efficiency.We will discuss the role of bankruptcy risks and costs on supply chain decisions,and outline future research directions.

4 - Pareto-Improving Manufacturer Pricing Policies When Consumers Stockpile
Candi Yano, UC Berkeley, IEOR Department and Haas School of Business, Berkeley, CA, 94720, United States of America, yano@ieor.berkeley.edu, Daphne Qi

Transportation economies of scale encourage retailers to place large orders infrequently, which then provides an incentive for them to offer retail discounts to clear inventory more quickly when consumers are prone to stockpile. We consider the effects of the retailer's pricing policy (high-low versus everyday low price) on the consumers' willingness to pay in this context, and show when and how a manufacturer can adjust his price structure to achieve Pareto-improving outcomes.

■ TB38

H-Sapphire D, Fourth Floor

Topics in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Nesim Erkip, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, nesim@bilkent.edu.tr

1 - Competitive Production Planning under Yield and Demand Uncertainty
Melike Baykal-Gursoy, Associate Professor, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu, Sara Ghorbani

We consider a market in which two retailers are planning their production level competitively in selling substitutable products such as olive oil and orange juice. We assume that retailers first lease farm land to grow olives or oranges, and then after observing the yield, decide on the production level. The market price of the product depends on the yield of both retailers. We show that there exists a unique equilibrium pair for both retailers.

2 - Integral Capacity and Inventory Decision Making in a Simple Production System
Nico Dellaert, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, Netherlands, N.P.Dellaert@tue.nl, Tarkan Tan, Simme Douwe Flapper, Jully Jeunet

This paper deals with the integral acquisition of capacity and material in a situation with uncertain demand, with non-zero lead-times for the supply of both materials and capacity. By using a DP formulation, we will describe the optimal balance between using safety stocks and contingent workforce. We will compare the optimal strategy with the standard inventory approach and derive characteristics that can provide a thorough basis for operational decision making.

3 - Optimal Sourcing Decisions Under Alternative Capacitated Suppliers
Tarkan Tan, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Pav F7, Eindhoven, 5600 MB, Netherlands, t.tan@tue.nl, Osman Alp

We consider sourcing decisions for a single item with stochastic demand. This item can be produced or supplied by a number of capacitated facilities ('sources'). We associate a separate fixed cost for initiating the usage of each source. We build a novel pseudo-polynomial dynamic programming model that we use for finding the solution to this NP-hard problem in one shot. We also propose a simple heuristic and build managerial insights, some of which are contrary to the collective intuition.

4 - A Final Phase Inventory Problem
Nesim Erkip, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, nesim@bilkent.edu.tr, Murat Fadiloglu, Onder Bulut

We consider a final phase inventory problem for a component that is no longer used as an input for manufacturing, but continues to experience stochastic demand during the warranty period. The supplier no longer receives the same economic value for the manufacturing of this component, as volume has decreased. We model the spare part inventory problem to reflect the behavior of the supplier and propose ways of renewing the agreement between the manufacturer and spare part distributor.

■ TB39

H-Sapphire E, Fourth Floor

Operations Models in Healthcare

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Burhaneddin Sandikci, Assistant Professor, The University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, burhaneddin.sandikci@chicagobooth.edu

1 - Rational Consumer Behavior in Influenza Vaccine Supply Chain
Sarang Deo, Assistant Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, s-deo@kellogg.northwestern.edu, Seyed Iravani, Kenan Arifoglu

We develop a newsvendor-like model for the influenza vaccine supply chain by including rational decision making by customers and manufacturer in the presence of yield uncertainty and negative externality due to infection dynamics. We find contrary to the existing economic models, that the expected demand in equilibrium can be higher than the socially optimal demand. We also characterize the gap between the social optimum and the equilibrium solution and discuss various coordinating mechanisms.

2 - New Inventory Policies in Healthcare: Taking Advantage of Technology
Claudia Rosales, University of Cincinnati, QAOM Dept, Business School, Cincinnati, OH, 45221, United States of America, rosalecr@email.uc.edu, Uday Rao, Michael Magazine

Healthcare providers are investing in new technology to improve availability of supplies and reduce total costs, allowing the use of inventory policies not previously considered. We study a hybrid inventory policy that combines the advantages of periodic replenishment, to achieve economies of scale, with the flexibility of out of period replenishments to respond to imminent stockouts. We discuss the benefits of this new policy versus traditional policies under single and multiple item scenarios.

3 - Mechanism Design in Organ Allocation
Stefanos Zenios, Stanford University, Graduate School of Business, Stanford, CA, 94305, United States of America, stefzen@GSB.Stanford.Edu, Anicham Kumarasami, Yichuan Ding

We will review two recent proposals to modify the kidney allocation system in the United States and discuss potential unintended consequences due to patient and physician self-interested behavior. We will outline preliminary models that can be used to capture these consequences and derive system design recommendations.

4 - Estimating the Value of the Liver Transplant Waiting List Information
Burhaneddin Sandikci, Assistant Professor, The University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, burhaneddin.sandikci@chicagobooth.edu, Lisa Maillart, Andrew Schaefer, Mark S. Roberts

The end-stage liver disease patients in the United States receive cadaveric liver transplants through joining a waiting list (WL). Patients on the WL are faced with the problem of accepting or rejecting an offered liver. We analyze this decision problem by formulating Markov decision process models and investigate the value of accessing WL information. We compare three models, assuming complete, partial, and no WL information, and present clinically driven numerical results.

■ TB40

H-Sapphire H, Fourth Floor

Capacity Allocation Among Multiple Demand Classes

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Ying Li, Assistant Professor, Texas A&M University, Mays Business School, College Station, TX, 77843, United States of America, yli@mays.tamu.edu

1 - Pricing, Scheduling and Admission Control: A Mechanism Design Approach
Max Shen, Professor, University of California-Berkeley, Dept of IEOR, Berkeley, CA, 94704, United States of America, shen@ieor.berkeley.edu, Tingting Cui, Ying-Ju Chen

We study a problem setting in which a capacity-constrained service provider modeled as an M/M/1 queueing system intends to serve several segments of customers. Customers are heterogeneous in their willingness to pay and their willingness to wait, both of which are private information. We show that a well-designed menu of admission control along with priority pricing contracts may force customers to reveal their true valuations and at the same time maximize the expected revenue for the server.

2 - Analysis of a Capacitated Make-to-order Production System with Two Products

Suleyman Demirel, PhD Candidate, University of Michigan, 701 Tappan Ave, Ann Arbor, MI, 48104, United States of America, sdemirel@umich.edu, Roman Kapuscinski, Izak Duenyas

We consider a manufacturer that stocks major sub-assemblies in stock and assembles products to order. We consider two products with their respective major sub-assemblies supplied by two outside suppliers. Suppliers face finite production capacity and the manufacturer faces a finite assembly capacity. We discuss the the optimal policy for the lost sales case and near-optimal policies for the backlogging case.

3 - Adaptive Capacity Allocation Systems

Wen-Ya Wang, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, wenya@ie.umn.edu, Diwakar Gupta

We develop a framework for the design of the next generation of appointment systems that dynamically learn and update customer preferences and use this information to continuously improve appointment-booking decisions. We apply these ideas to the design of appointment systems for primary-care clinics and report results from numerical experiments.

4 - A Remanufacturing Inventory System with Lost Sales: Push, Pull and Hybrid Strategies

Justin Jia, Penn State University, 483A Business Building, University Park, PA, 16802, United States of America, zuj100@psu.edu, Daniel Guide, Susan Xu

We study a single-product periodic-review inventory system, in which a firm remanufactures returned products of heterogeneous qualities to meet demand for refurbished items. Remanufacturing takes a unit time and incurs a quality-dependent production cost. Unmet demand is lost. We investigate the Remanufacture-to-Stock (RTS), Remanufacture-to-Order (RTO), and hybrid RTS/RTO strategies, derive structural properties of the optimal decision rules, and develop efficient solution algorithms.

5 - Prioritizing Regular Orders While Reserving Capacity with Emergency Demands

Xinxin Hu, Assistant Professor, Indiana University, 1309 East 10th Street, Bloomington, IN, 47405, United States of America, hux@indiana.edu, Ying Li, Eunshin Byon, Barry Lawrence

We consider a capacity reservation problem faced by an oil service and equipment company which offers the different types of products and routinely faces emergency orders. In a multiple period dynamic setting, we propose the structured optimal policy about how to reserve regular capacity for the coming uncertain emergent orders, which have to be fully satisfied with the help of expensive safety capacity, as well as how to allocate the remaining capacity among the different regular products.

■ TB41

H-Sapphire L, Fourth Floor

Service to Manufacturing

Contributed Session

Chair: Valerie C. Y. Zhu, PhD, The School of Management of Xi'an Jiao Tong University, No. 28, West of Xian Ning Road, Xi'an, 710049, China, valeriezhu@mail.xjtu.edu.cn

1 - Model Development for Production of Critical Flashover (CFO) Voltage of Various Material Combination Used in Power Distribution System

Mohammad Quasem, Associate Professor, Howard University, Washington, DC, 200059, United States of America, mquasem@howard.edu

In this study, FRP polymer and wood add to the classic porcelain insulation. The impact of the assembly of the materials has been observed. Four sets of two component materials and combinations of their components in series has been tested. Finally predictions of insulation strength have been made on how one component would supplement another. This study may be helpful in obtaining optimal choice of diolectrics used on power distribution system.

2 - The Service Transformation of Chinese Product Manufacturing Companies in the Financial Crisis

Ding Wei, Xi'an JiaoTong University, Mailbox 1888, Xian JiaoTong University, Xi'an, 710049, China, weidingxjtu@gmail.com, Zhe HE

Manufacturing industry has being the main driving force of China's economy, though it faces: low value-added products and irrational industry structure. The impact of financial crisis forces us to reconsider its developing mode. By extending enterprises' value chains and promoting the product value-added, service transformation has become more and more important to the manufacturing companies in China. This paper focuses on identifying the strategies of companies' service transformation.

3 - Measurement, Character and Changing Trend of China's Manufacturing Regional Specialization

Anbo Wu, School of Management, Xi'an Jiaotong University, P.O.Box 1888,No.28, Xianning West Road, Xi'an, SX, 710049, China, brenda8616@gmail.com

This study measures regional specialization(RS) degree of China's 29 provinces and 18 manufacturing industries from 1988 to 2006 by using RS coefficient constituted by Fan(2007). And the study analyzes character and changing trend of China's RS. Results show overall RS degree of China's manufacturing industry increased annually. 4 industries' degrees are higher than others. Specialized work division is enhanced. Structural heterogeneity of industries between provinces continuously ascends.

4 - Optimal Selections for Foundry and Fabless with Demand and Coverage Considerations

Zehra Bilginturk Yalcin, University of Texas at Austin, University Station 1, C2200, Austin, TX, 78703, United States of America, zbilginturk@yahoo.com

We examine two problems that arise in semiconductor manufacturing industry. Foundry selection and demand coverage problem looks at the system from fabless company's point of view and is concerned with optimally selecting a set of foundries to satisfy the demand coming from a range of markets while minimizing total cost. Fabless selection and capacity allocation problem, on the contrary, is interested in foundry's problem of fabless company selections and scheduling of selected customer orders.

5 - Insights into Operations Management

Valerie C. Y. Zhu, PhD, The School of Management of Xi'an Jiao Tong University, No. 28, West of Xian Ning Road, Xi'an, 710049, China, valeriezhu@mail.xjtu.edu.cn, Lin'yan Sun

This paper offers insights into the research of operations management in service-manufacturing—-a new "industry" with a close marriage between service and manufacturing. The concept of service-manufacturing has been iterated; the value creation and aggregation model in service-manufacturing has been demonstrated; the theoretical framework and the research agenda of operations management in service-manufacturing have been illustrated.

■ TB42

H-Sapphire P, Fourth Floor

SCM for Make-to-Order Products

Contributed Session

Chair: Jooyol Maeng, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States of America, maengjy@purdue.edu

1 - Engine Build Model for Aircraft Engines at United Airlines

Kumar Satyam, Senior Analyst, United Airlines, 1200 E Algonquin Road, Elk Grove Township, IL, 60007, United States of America, kumar.satyam@united.com, Feryal Kuran

This model determines the target life cycle an aircraft engine should be built to during maintenance visits to minimize the total cost associated with engine. Further, the model optimizes assignment of available parts across different engines for a time period based upon various related business policies.

2 - Optimal Bulk to Case Product Mix in a Supply Chain

Jooyol Maeng, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States of America, maengjy@purdue.edu

The study is on a leading wine bottle manufacturer that provides a high level of customization and services for its customers. It operates under the make-to-order system, but the highly volatile nature of demand on wine industry often creates a huge discrepancy between sales orders and actual demands, which results in frequent order cancellations. The characteristic of items with poor forecast is investigated in the study.

3 - A Strategic Design of a Traditional Channel: The Entry of Direct Online Sale and the MSRP

Zhaoqiong Qin, Associate Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro NC 27411, United States of America, zqin@ncat.edu

This paper investigates the effect of two strategies including the entry of a direct channel and the MSRP (manufacturer's suggested retail price) on the "double marginalization" compared to the decentralized traditional channel. Our results show that both strategies can help to relieve the "double marginalization". Furthermore the degree of the relief depends on the values of the parameters in the study.

■ TB43

H-Room 400, Fourth Floor

Managing Uncertainty in Supply Chains

Cluster: Supply Chain Models
Invited Session

Chair: Nan Yang, Assistant Professor, Cornell University, ny38@cornell.edu

1 - Balancing Learning and Economies of Scale: The Adaptive Clinical Trial Case
Yao Zhao, Associate Professor, Rutgers University, 180 University Ave, Newark, NJ, United States of America, yaozhao@andromeda.rutgers.edu, Adam Fleischhacker

In clinical trials, drug candidates may experience significant uncertainties in demand due to the unknown dosage and number of patients. However, most of these factors can be learned during the trial. To take advantage of this learning, intra-trial batches can be produced, but at the expense of scale economies. Under various learning curves, we study this balance between learning and economies of scale to optimally schedule and size production.

2 - Trade Credit and Supply Chain Management
Min Wang, Columbia University, 2960 Broadway, New York, NY, 10027, United States of America, mwang13@gsb.columbia.edu, Awi Federgruen

In this paper, we analyze decentralized supply chain arrangements involving a supplier and one or several buyers. To stimulate demand and overcome credit limitations experienced by the buyers, the supplier sells the goods on consignment, demanding invoice payment along, with general credit charges, only at the time goods are sold by the buyer. We provide systematic comparisons with the traditional supply chain models in which buyers pay for their purchases upon delivery or shipment of the goods.

3 - Managing Random Disruptions of Random Duration
Tony Arreola-Risa, Associate Professor, Texas A&M University, INFO Department, Mays Business School, College Station, TX, 77843-4217, United States of America, A-Arreola-Risa@mays.tamu.edu, William Stein

We study a production-inventory system with stochastic demands and manufacturing times, where the manufacturing process experiences random disruptions of random duration. The inventory is managed by a base-stock policy. The objective is to find the optimal base-stock level.

4 - Matching Supply and Demand in the Presence of Multiclass Suppliers and Customers
Long Gao, Assistant Professor, University of California, Riverside, CA, long.gao@ucr.edu, Nan Yang

We study a multiperiod supplier selection and order acceptance problem in the presence of multiclass suppliers with random yields and random demands from multiclass Customers. We characterize the structure of the optimal policy and investigate the impact of system parameters. We numerically compare the performance of several widely used policies with that of the optimal policy under different scenarios, and provide recommendations for the management.

5 - Optimal Order and Effort Decisions in the Newsvendor Model
Charles Wang, SUNY Buffalo, School of Management, Buffalo, NY, United States of America, cxwang@buffalo.edu

In this paper we consider a newsvendor who sells a short life-cycle product with uncertain and effort-dependent demand. We derive the optimal order and sales effort decisions in the newsvendor model and provide some managerial insights.

■ TB44

H-Room 402, Fourth Floor

Uncertainty Management in Services

Sponsor: Service Science
Sponsored Session

Chair: Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

1 - Stochastic and Determenistic Processes in Ambulatory Care Affecting Quality of Care
John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

Ambulatory care, like most service industries, cannot meet changes in demand through inventory. The co-production of value is strongly constrained and controlled by 2 interacting processes: predicting and meeting service demand and understanding and controlling patterns. We will present analysis and subsequent applied solutions affecting quality of care in Emergency Departments, Primary and Specialty Care settings.

2 - Techniques for Reducing Uncertainty
Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

We define uncertainty as the difference between information needed versus the information we actually have to complete a task or to make a decision. Managing uncertainty are the methods, processes, and tools to reduce this information gap. We present and discuss the difference between uncertainty and risk. We present a number of ways to manage some key uncertainties in services.

3 - Uncertainty-aware Service
Genady Grabarnik, Scientist, Ritesoft, 126 Brambach Rd, Hawthorne, NY, 10532, United States of America, genadyg@gmail.com, Larisa Shwartz

Service, as a co-production of provider and consumer, is a reactive system that constantly interacts with its environment by reaching to incoming stimuli that may arrive at any stage of the service life cycle. However, risk identification and assessment in services is mostly static and custom built on the data that gathered manually using techniques that relevant for individual service; the existing tools for service design and planning don't have meaningful mechanisms for managing uncertainty.

■ TB45

H-Room 410, Fouth Floor

Perspectives on Product Development Challenges

Cluster: New Product Development
Invited Session

Chair: Stylianos Kavadias, Associate Professor, Georgia Institute of Technology, 800 W. Peachtree Street, Atlanta, GA, 30308, United States of America, Stylianos.Kavadias@mgt.gatech.edu

1 - Design and Introduction of Conspicuous Durable Products
Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, 30308, United States of America, vishal.agrawal@mgt.gatech.edu, Stylianos Kavadias, Beril Toktay

We study the implications of exclusivity-seeking consumer behavior (snob effect) on the durability and pricing choices of the firm. There is an extensive body of literature that argues for the benefit of designing products with low durability (planned physical obsolescence). We show that in presence of exclusivity-seeking consumer behavior, firms should design products that undergo slow value erosion coupled with a high-price, low-volume product introduction strategy.

2 - Launching a Thousand Ships: Incentives for Parallel Innovation
Florian Ederer, Assistant Professor, UCLA Anderson, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, ederer@mit.edu

In a setting where workers can freely exchange ideas under-exploration may result as workers free-ride. Optimal incentives for routine activities take the form of individual pay-for-performance, while for parallel innovation they tolerate early failure and provide long-term group incentives for joint success. Using data from a laboratory experiment I show that this link is causal. Innovation success is highest when subjects receive a group incentive scheme that rewards long-term joint success.

3 - The Impact of Different Types of Input in the Design of Assistive Technology Products
Young-Mi Choi, Ph.D. Candidate, Center for Assistive Technology and Environmental Access (CATEA), 490 Tenth Street, Atlanta, Atlanta, GA, 30332-0156, United States of America, christina.choi@gatech.edu

One of the challenges facing developers of new Assistive Technology (AT) products is in utilizing input gathered from end users during the design process to gain a full understanding of their needs. A controlled design study was undertaken to measure how different types of input (from end users, therapists and simulation) during the design process affect the level of satisfaction and effectiveness of the finished AT product. The goal is to identify possible ways to improve the design process.

■ TB46

H-Room 411, Fourth Floor

Vehicle Routing and Uncertainty

Sponsor: Technology Management
Sponsored Session

Chair: Tom Van Woensel, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav F5, Eindhoven, Netherlands, t.v.woensel@tue.nl

1 - Multi-Objective Time-Dependent Capacitated Vehicle Routing Problem with Time Windows

Said Dabia, Eindoven University of Technology, PostBus 513, Eindhoven, Netherlands, s.dabia@tue.nl

A limited fleet of vehicles serve a set of geographically scattered customers. Every vehicle has a finite capacity and limited time availability, and is allowed to make several tours during its operating period. Travel times are time-dependent and all customers need to get delivered in their specific time windows. We aim to minimize the total time travelled including any waiting times, while the total quantity delivered is maximized. Efficient dynamic programming algorithms are developed.

2 - Dynamic Routing Using Real-time ITS Information

Ali R. Guner, Research Assistant, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, arguner@wayne.edu, Ratna Babu Chinnam, Alper Murat

Growing travel time delays and variability in transportation networks are negatively impacting the efficiency of JIT logistics. Recurrent congestion is one of the primary reasons for delivery delay and variability. We model the problem as a time dependent TSP and propose a stochastic DP formulation for dynamic routing of a vehicle in non-stationary stochastic networks subject to recurrent congestion. Results are tested in a network of Southeast-Michigan using historical ITS data.

3 - Consistent Vehicle Routing with Stochastic Customers: A Stochastic Programming Formulation

Ola Jabali, PhD Student, Technische Universiteit Eindhoven, Den Dolech 2 Pav. E.17, P.O.Box 513, Eindhoven, 5600 MB, Netherlands, o.jabali@tue.nl, Rei Walter, Tom Van Woensel, Ton de Kok, Michel Gendreau

We consider the consistent vehicle routing problem, in which customers are stochastic with respect to their occurrence. For these customers we want to provide consistent service, this is insured by having the same driver visit a customer when it requests service. Furthermore, for each customer we set a target arrival time. Realized deviations from the targets are penalized . We propose a stochastic programming approach, where the sequence and the targets are set in an a priori manner.

4 - Reliability in Vehicle Routing with Time Windows

Tom Van Woensel, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav F5, Eindhoven, Netherlands, t.v.woensel@tue.nl, Nico Dellaert, Duygu Tas

A vehicle routing problem is considered where reliability is considered important. Delivery reliability becomes more and more an order qualifier which is reflected by the customer's time windows. We consider stochastic travel time distributions, analyze the propagation through the network and the interplay with the customer's time windows. The value to the reliability of using these distributions in VRPTW is discussed and demonstrated on a number of instances.

■ TB47

H-Room 412, Fourth Floor

Teaching Service Supply Chain Management: Curriculum and Methods

Cluster: Global Sourcing of Services
Invited Session

Chair: Morgan Swink, Professor, Michigan State University, Broad College of Business, Department of SCM, East Lansing, MI, 48824, United States of America, swink@bus.msu.edu

1 - Global Outsourcing of Professional Services

Natalia Levina, Associate Professor, NYU, Kaufman Management Center, 44 West 4th Street, Room 8-78, New York, NY, 10012, United States of America, nlevina@stern.nyu.edu

I will overview the objectives, syllabus, teaching methods, and exercises that I use in an MBA course on Global Outsourcing Strategy at New York University, Stern School of Business. I will also talk about the evolution of the course over 5 years that I have been teaching it.

2 - Designing a Graduate Supply Chain Management Course

Terry Harrison, Professor of Supply Chain and Information Systems, Penn State University, 459 Business Building, University Park, PA, 16802, United States of America, tharrison@psu.edu

I describe the design of a required MBA-level supply chain management course and how it has evolved over time. In particular, I emphasize efforts to make supply chain management principles relevant and interesting to a non-supply chain oriented student. I conclude by participating in a panel discussion on relating these course design ideas to the development of a services supply chain course.

3 - Teaching Service Supply Chain Management and OM Concepts in an EMBA Course

Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

Teaching Service Supply Chain Mgt and OM Concepts in an EMBA Course The presenter has taught the core POM course for the EMBA program jointly offered by Cornell and Queens University for the last two years. This course is delivered by synchronous media at over 10 locations in US and Canada. We will discuss the some of the unique aspects of teaching a service and supply chain-focused course in this environment.

■ TB48

H-Sapphire Green Room, Fourth

Empirical Studies in Service Operations

Cluster: Service Operations Management
Invited Session

Chair: Carrie Queenan, University of Notre Dame, 379 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, c_queenan@nd.edu

1 - Implications of Zones of Tolerance on Service Quality

Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 117B Sirrine Hall, Clemson, SC, 29631, United States of America, gulruo@clemson.edu, Janis Miller, Jason Thatcher

We explore the concept of Zones of Tolerance (ZOT) for service quality. ZOT suggests individuals anticipate different levels of service quality at different price points. We examine the tradeoff between meeting, versus exceeding customers expected levels of satisfaction based on two metrics of firm performance - short term profits and long term customer retention. Our focus is to examine how overall service performance contributes to sustained competitive advantage of service organizations.

2 - Habitual Citizenship Behavior

Reidar Hagtvedt, University of Alberta - School of Business, 2-43 Business Building, Edmonton, Alberta, Canada, hagtvedt@ualberta.ca, Kenneth L. Schultz, Nicola T. Shaw, Sarah Forgie, Gregory Todd Jones

Habitual Citizenship Behavior (HCB) is our generalization of hand-hygiene behavior in hospitals. Compliance with regulations is low, in spite of wide-spread hospital-acquired infections. Hand-hygiene is low cost, no risk to the health care worker, usually of no impact on the patient, but when there is an impact, the outcome is often catastrophic. We deployed a survey to map the relevant psychological constructs, and an observational study for the habitual aspects of compliance.

3 - Which Comes First, Technology or Performance? Technology's Temporal Effect in Healthcare

Carrie Queenan, University of Notre Dame, 379 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, c_queenan@nd.edu, Sarv Devaraj, Corey Angst

We often assume that technology investment unidirectionally drives more efficient organizations. However, an organization needs capital to invest in technology, which could come from more efficient organizations. Which comes first? Using Granger causality methodology, we investigate this question when implementing CPOE in a hospital setting. This study contributes to the literature by investigating the business value of CPOE and the temporal question of 'which comes first'?

■ TB49

H-Room 300, Third Floor

Transportation and Coordination to Manage Supply Chain Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Sanjay Kumar, Penn State Erie, 5101 Jordan Rd., Erie, PA, 16563, United States of America, sxk89@psu.edu

1 - Supply Chain Disruption and Recovery by Coordination

Vivek Mahanta, PhD Candidate, Drexel University, Department of Decision Science, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, vsm24@drexel.edu, Seung-Lae Kim

Disruptions in an n-supplier-m-retailer supply chain can take time and cost to recover and return to profitability. In this paper we consider coordination models under buyback, revenue sharing and quantity discount contracts to compare which models foster faster recovery. Simulation studies are conducted to validate the results.

2 - Real-Time Planning with Coordination Under Uncertainty
Nalan Gulpinar, Associate Professor, The University of Warwick, Warwick Business School, Coventry, CV6 1PY, United Kingdom, Nalan.Gulpinar@wbs.ac.uk, Ethem Canakoglu

Autonomous systems require real-time decision making capabilities for adaptive mission planning in dynamic and uncertain environment. Planning and coordination are essential for team management to achieve specific goals and have significant impact on team performance. In this paper we introduce a real-time planning framework that integrates team composition and coordination under uncertainty.

3 - Benefit-cost Analysis of Railroad Infrastructure Improvement to Reduce Transportation Risk
Xiang Liu, Graduate Research Assistant, University of Illinois at Urbana Champaign, B-118 Newmark Civil Engineering Lab, 205 N Mathews Ave., Urbana, IL, 61801, United States of America, liu94@uiuc.edu, Christopher P.L Barkan

We are developing a framework to assess the cost effectiveness of railroad infrastructure improvement to reduce transportation risk. Improved railroad track condition reduces accident probability but increases capital and maintenance costs. Our model is intended to consider the trade-off between reduced accident rates and increased costs in evaluating railroad risk-reduction strategies and operational decisions.

■ TB50

H-Room 302, Third Floor

Managing and Structuring Services

Sponsor: MSOM/ Service Management
Sponsored Session

Chair: Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu

1 - Cheap Talk in Queues
Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Achal Bassamboo

Delay announcements informing customers about anticipated delays are prevalent in service-oriented systems. How delay announcements can influence customers in service systems is a complex problem. We examine this problem of information communication by considering a model in which both the firm and the customers act strategically: the firm in choosing its delay announcement while anticipating customer response, and the customers in interpreting these announcements.

2 - Dynamic Pricing and Bayesian Learning of Customer Time-Sensitivity in Queues
Philipp Afeche, University of Toronto, Rotman School, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, afeche@rotman.utoronto.ca, Baris Ata

Virtually the entire revenue management literature for queues assumes that providers know the distribution of customer demand attributes. We relax this assumption and consider the case of unknown customer impatience. We characterize the dynamic pricing policy that optimally trades off revenue generation and learning customer demand.

3 - Coexistence of Selling and Renting in a Durable Goods Market
Haoying Sun, Doctoral Student, McCombs School of Business, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, Haoying.Sun@phd.mccombs.utexas.edu, Steve Gilbert, Ramandeep Randhawa

We consider a durable goods retailer that serves consumers who have different usage frequencies. We examine the trade-offs between selling the durable and renting it, one use at a time. While selling minimizes transaction costs, renting provides a more efficient allocation of the available products. Focusing on these trade-offs we identify conditions under which the retailer should only sell, only rent, or offer a combination of sales and rentals.

4 - Process and Contract Design When Outsourcing a Two-Level Service Process
Hsiao-Hui Lee, Simon School, University of Rochester, University of Rochester, Rochester, NY, 14627, United States of America, hsiao-hui.lee@simon.rochester.edu, Edieal Pinker, Robert Shumsky

We consider a two-level service process with the first level as a gatekeeper for the second level. We study the outsourcing of this process including, which part to outsource (first level, second level, or both) as well as the contract design. We derive conditions for the existence of system optimal coordinating contracts and explore how labor cost savings influence optimal outsourcing.

■ TB51

H-Room 303, Third Floor

Computational Integer Programming

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster Computing)
Sponsored Session

Chair: Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca

1 - Valid LP Bounds for Exact Mixed Integer Programming
Daniel Steffy, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30308, United States of America, dsteffy@isye.gatech.edu, William Cook

Successful approaches have recently been developed to efficiently solve LPs exactly and a current research focus is to solve MIPs exactly. Solving an exact LP at each node of the B&B tree is computationally expensive and can often be avoided when valid bounds can be computed. We present a new method for generating valid LP bounds without solving exact LPs. The method relies on repairing approximate LP solutions and extends some current methods by not requiring upper and lower variable bounds.

2 - A Pseudocost-based Tree Size Estimation Method for Mixed Integer Programs
Jeff Linderoth, University of Wisconsin, 1513 University Ave, 3226 Mechanical Engineering Building, Madison, WI, United States of America, linderot@cae.wisc.edu, Wasu Glankwamdee

We describe a mechanism to estimate the size of the search tree resulting from a branch-and-bound method for solving mixed integer programs. Pseudocosts are used as a key ingredient in estimation procedure. The method can be used as the branch and bound search progress, does not require knowledge of feasible solution values in order to make estimates, and should be easily implementable in any mixed integer programming solver. Computational results will be given.

3 - Generating Multiple Rounds of Rank-1 GMI Cuts
Marcos Goycoolea, Universidad Adolfo Ibañez, Avda. Diagonal Las Torres 2640, Penalolen, Santiago, Chile, marcos.goycoolea@uai.cl, Sanjeeb Dash

Gomory mixed-integer (GMI) cuts are among the most effective cutting planes for general mixed-integer programs (MIP). They are traditionally generated from an optimal basis of the initial linear programming (LP) relaxation of an MIP. We propose a heuristic to generate additional useful rank one GMI cuts from other bases of the initial LP relaxation. Extending our technique we show how to generate globally valid GMI cuts from nodes of a branch-and-bound tree.

4 - Gurobi MIP Solver
Zonghao Gu, Gurobi Optimization Inc., 4050 Walnut Creek Trail, Alpharetta, GA, 30005, United States of America, gu@gurobi.com, Robert Bixby, Ed Rothberg

First we will briefly describe the design of the algorithmic framework, which has been built from the ground up to provide maximum flexibility in exploiting modern strategies for solving mixed-integer programs. Then we will discuss our approaches to handling the key MIP issues, such as cutting planes, search, heuristics and presolve. Finally, we will present computational results about the Gurobi MIP solver.

■ TB52

H-Room 304, Third Floor

Operations Management/Marketing Interface

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Lauren Xiaoyuan Lu, Assistant Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, Lauren_Lu@unc.edu

1 - Durable Products, Time Inconsistency and Lock-in
Sree Jonnalagedda, Doctoral Student, UT Austin, McCombs school of Business, Austin, TX, 78712, United States of America, sree.jonnalagedda@phd.mccombs.utexas.edu, Steve Gilbert

For durable products that require a contingent consumable, firms may lock-in consumers by making their products incompatible with non-proprietary consumables. Under lock-in, strategic consumers anticipate higher prices for the contingent consumable. However, we show that lock-in also reduces the firm's incentive to reduce the price of its durable over time. Thus, it mitigates time inconsistency, and may either increase or decrease consumers' willingness to pay for the durable.

2 - Strategic Role of In-house Procurement Capability When Production is Outsourced

Stephen Shum, Hong Kong University of Science & Technology, School of Business and Management, Clear Water Bay, Hong Kong - ROC, sshum@ust.hk, Ying-Ju Chen, Wenqiang Xiao

We investigate the impact of a firm's procurement capability on the supply chain efficiency in the context of outsourcing. Specifically, an original equipment manufacturer (OEM) relies on a contract manufacturer (CM) to assemble her products that require a critical component from outside suppliers. We study two scenarios, depending on whether the OEM has in-house procurement capability, and characterize the OEM's optimal procurement and contracting decisions.

3 - Implications of the Long Tail Effect

Tom Tan, Doctoral Candidate, The Wharton School, University of Pennsylvania, fangyun@wharton.upenn.edu, Serguei Netessine

The Long Tail effect is a new demand pattern resulting from the Internet impact; people show a propensity to consume more niche products, thus causing the tail of the demand distribution to grow longer and fatter. In this talk we discuss empirical evidence for and against the Long Tail effect as well as demonstrate analytical approaches to modeling its consequences.

4 - Design Outsourcing in a Differentiated Product Market: The Role of Bargaining and Scope Economies

Lauren Xiaoyuan Lu, Assistant Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, Lauren_Lu@unc.edu, Annabelle Feng

During the last two decades, original equipment manufacturers (OEMs) gradually extended their outsourcing activities beyond manufacturing and outsourced product design and development to original design manufactures (ODMs). This new outsourcing model shifts the control of product design from an OEM to an ODM. We develop a dynamic game to study how design outsourcing may impact product differentiation and downstream competition among OEMs.

■ TB53

H-Room 305, Third Floor

Integer Programming and Computational Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Yongpei Guan, Assistant Professor, Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - Linear and Mixed-Integer Models for Continuous Piecewise Linear Fitting

Alejandro Toriello, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, atoriello@gatech.edu, George Nemhauser, Juan Pablo Vielma

We propose linear and mixed-integer optimization models for the problem of fitting a continuous piecewise linear function to a finite set of data points. The models we study range from the separable case over a fixed grid to the non-separable convex case over variable regions introduced by Magnani and Boyd. We also study the additional constraints required to impose convexity on the best-fit function.

2 - Using Infeasible Nodes to Select Branching Variables

Emilie Danna, IBM, 1195 W Fremont Avenue, Sunnyvale, CA, 94087, United States of America, edanna@us.ibm.com, Andrea Lodi

In mixed integer programming, the choice of the branching variable is traditionally based on the history of changes in objective value caused by branching. This pseudocost strategy does not take into account branching decisions that create an infeasible child node. In this presentation, we describe how to integrate infeasible nodes into the branching variable selection. We discuss several alternatives and we show with computational experiments that our approach improves on the state of the art.

3 - Robust Unit Commitment Problem

Muhong Zhang, Asst Professor, Arizona State University, Arizona State University, Department of Industrial Engineering, Tempe, 85287, United States of America, Muhong.Zhang@asu.edu, Yongpei Guan

As energy market transforms from a regulated market to a deregulated one, the demands for the power plants are highly uncertain. In this talk, we study a two-stage robust optimization model of the unit commitment problem and provide a tractable solution approach for the problem. The computational experiments show the effectiveness of our approach.

4 - On Equivalence of Some Scale-reduction Techniques for the Maximum Weight Independent Set Problem

Sergiy Butenko, Associate Professor, Texas A & M University, College of Engineering, College Station, TX, 77843, United States of America, butenko@tamu.edu, Jianer Chen, Svyatoslav Trukhanov

We compare four different approaches used to reduce the size of an instance of the maximum independent set problem that have been proposed in the literature. We show that, even though each of the techniques were motivated by seemingly very different ideas, they are all equivalent in the sense that the reduced graph output by one of the algorithms cannot be further reduced by any other of the four methods.

■ TB54

H-Room 306A, Third Floor

New Perspectives on Machine Learning

Sponsor: Optimization/Networks
Sponsored Session

Chair: Nina Balcan, Microsoft, mabalcan@microsoft.com

1 - Machine Learning for Mechanism Design and Pricing Problems

Avrim Blum, Professor, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, avrim@cs.cmu.edu

A key problem in electronic commerce is the development of auction mechanisms for selling large quantities of items to buyers with complex preferences and needs. In this work we show how methods from machine learning can be used to produce simple approaches for achieving high revenue for a wide variety of such mechanism design problems. From a learning perspective, these settings present a number of challenges including a loss function that is discontinuous, asymmetric, and has a large range.

2 - Hierarchical Sampling for Active Learning

Sanjoy Dasgupta, University of California, San Diego, 9500 Gilman Drive #0404, La Jolla, CA, 92093, United States of America, dasgupta@cs.ucsd.edu

Active learning is a classifier learning scenario where all data points initially have their labels hidden. Any label can be revealed at a price, and the goal is to learn a good classifier while paying as little as possible. I'll present a scheme for active learning that is able to exploit cluster structure in data.

3 - Activized Learning: Transforming Passive to Active with Improved Label Complexity

Steve Hanneke, Carnegie Mellon University, Department of Statistics, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, shanneke@cs.cmu.edu

In active learning, a learning algorithm is given access to unlabeled examples, and can sequentially select examples to get labels for. In this talk, I will explain how to use any passive learning algorithm as a subroutine to construct an active learning algorithm that provably achieves an asymptotically superior label complexity.

4 - The Price of Uncertainty

Maria Florina Balcan, Assistant Professor, Georgia Institute of Technology, School of Computer Science, Atlanta, GA, 30332, ninamf@cc.gatech.edu

We study the degree to which small fluctuations in costs in well-studied potential games can impact the result of natural best-response and improved-response dynamics. We show that in certain cases, even extremely small fluctuations can cause these dynamics to spin out of control and move to states of much higher social cost, whereas in other cases these dynamics are much more stable even to large degrees of fluctuation.

■ TB55

H-Room 306B, Third Floor

Generalized Assignment Problems

Contributed Session

Chair: Robert Nauss, Professor, University of Missouri-St. Louis, 1 University Blvd., 209 CCB, St. Louis, MO, 63121, United States of America, robert_nauss@umsl.edu

1 - An Integer Programming Formulation for an Optimal Student Class Assignment Problem

Anand Seshadri, Dr., Booz Allen Hamilton, 8283 Greensboro Drive, McLean, VA, 22102, United States of America, seshadri_anand@bah.com, John Foreman, Nicholas Nahas, Cenk Tunasar

An integer programming formulation with a simultaneous equation postprocessor has been developed to optimally allocate student schedules in a training program. The objective of the optimization is to minimize the total number of students for each month. The formulation is efficient enough to implement in a stand-alone computer using Microsoft Excel in order to comply with client requirements. The postprocessor utilizes the output of the integer program to derive the final assignment of students.

2 - Random Combinatorial Problems on Hypergraph Matchings: Limiting Optimal Values and Convergence Rates

Pavlo Krokhmal, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, krokhmal@engineering.uiowa.edu

We consider random combinatorial optimization problems on hypergraph matchings, such as multidimensional assignment problems (Linear MAP, Bottleneck MAP, etc.), whose assignment costs are iid random variables. Convergence of the optimal values of such problems as functions of the problem dimensions is investigated. For a broad class of distributions of the assignment costs, we demonstrate convergence in L1 and almost surely, establish the convergence limits and corresponding convergence rates.

3 - A Class of Generalized Assignment Problems with Flexible Demand and Shared Resource Consumption

Chase Rainwater, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, chaserainwater@gmail.com, Joseph Geunes, Edwin Romeijn

We study a class of assignment problems that is applicable to various planning scenarios. In this problem class each job belongs to one of several job types. A fixed amount of capacity is consumed if any one of the jobs from a particular type is assigned to a given resource. In addition, the demand requirements associated with each job contain a form of flexibility. We propose and exact solution methodology for this class of problems and provide computational results.

4 - Repetitive Job Assignment Problem

Kursad Derinkuyu, The University of Texas at Austin, Operations Research / Industrial Eng, 1 University Station C2200, Austin, TX, 78712, United States of America, kursad@mail.utexas.edu, Anant Balakrishnan

We study a field service problem for a single resource and a given sequence of jobs. Each job requires multiple service operations to be performed periodically, and each operation has a time-varying completion cost that depends on the previous service time. We show that the problem is NP-Hard, describe an efficient algorithm for a special case, embed this method in a heuristic for the general problem, and discuss successful computational results.

5 - The Single Source Capacitated Facility Location Problem

Robert Nauss, Professor, University of Missouri-St. Louis, 1 University Blvd., 209 CCB, St. Louis, MO, 63121, United States of America, robert_nauss@umsl.edu

We propose a solution technique to solve hard instances of the Single Source Capacitated Facility Location Problem that take CPLEX over 8 hours to solve. When all facility variables are fixed, the remaining problem of 0-1 variables is a generalized assignment problem. After invoking certain relaxation tightenings and a heuristic to generate a good feasible solution, we generate a list of GAP problems that must be solved in order to ensure that an optimal solution to the SSCFLP is found.

■ TB56

H-Room 307, Third Floor

Advances in Nonlinear Programming Algorithms

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

1 - Modern First-Order Augmented Lagrangian Methods for Nonlinear Programming

Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu, Paulo J.S. Silva

We study augmented Lagrangian algorithms on the CUTEr nonlinear optimization test set, solving subproblems by Hager and Zhang's ASA box-constrained conjugate gradient method. We compare (1) the classic quadratic penalty versus log-quadratic and similar kernels, (2) dual versus primal-dual regularization, and (3) exact solution versus relative error subproblem termination. The results are somewhat different than we expected based on our earlier work on complementarity problems.

2 - An Interior-point Algorithm with Inexact Step Compuations

Frank Curtis, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America fecurt@gmail.com, Andreas Wächter, Olaf Schenk

We present an interior-point algorithm for nonlinear programming. The novelty of the method is that inexact solutions of the primal-dual equations are allowed during each iteration so that the method is efficient for large-scale applications, yet global convergence guarantees are still provided. Thus, the method presents a viable framework for large general-purpose problems, as we indicate with numerical results for PDE-constrained applications.

3 - Interior-Point Methods for NLP: Convergence Analysis and Computational Performance

Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu, Arun Sen, David Shanno

We present global and local convergence results for an interior-point method for NLP and analyze the computational performance of its implementation. The algorithm uses a penalty approach to relax constraints, provide regularization, and bound the Lagrange multipliers. Numerical testing on a set of NLPs, including degenerate and infeasible problems, confirm the theoretical results. We analyze the effects of enforcing theoretical convergence on the computational performance of the algorithm.

4 - On the Estimation of Behavioral Dynamics

Fabian Bastin, Assistant Professor, Université de Montréal, Dpt of Computing Science and Oper. Res., CP 6128, Succ Centre-Ville, Montreal, H3C 3J7, Canada, bastin@iro.umontreal.ca, Renting Xu, Cinzia Cirillo

Behavioral models are a key component of many studies related to marketing, transportation,... They are however mainly static, ignoring the sequence of individual choices. We consider here the process leading individuals to make specific purchase choices over time, and focus on the associated estimation problem. This is a basic maximum likelihood, where each individual choice however requires to solve a regenerative optimal stopping problem.

■ TB57

H-Room 308, Third Floor

Assessing Hospital Operations

Sponsor: Health Applications
Sponsored Session

Chair: Anita Vila-Parrish, North Carolina State University, 2248 Cranford Road, Durham, NC, 27705, United States of America, anita.vilaparrish@gmail.com

1 - Allocating Fixed Costs via Planning Models with Clearing Functions

Ali Kefeli, North Carolina State University, 2717 Brigadoon Drive, Raleigh, NC, 27606, United States of America akefeli@ncsu.edu, Reha Uzsoy

Although body of literature on cost accounting is extensive, research that has focused on mathematical programming models are of particular interest since they are derived from a rational model of maximizing a particular objective for the firm. In this paper we incorporate nonlinear congestion effects into these mathematical programming models and show the advantage of improved dual prices provided by those enhanced planning models, for cost allocation schemes proposed in the literature.

2 - Application of Perishable Inventory Models to a Hospital's Medication Supply Chain

Anita Vila-Parrish, North Carolina State University, 2248 Cranford Road, Durham, NC, 27705, United States of America anita.vilaparrish@gmail.com, Julie Ivy, Russell E. King

Pharmaceutical inventory management presents many challenges to practitioners because of uncertainty in demand and short shelf lives of the medications. In this research we formulate a perishable inventory model which has many applications to the hospital pharmaceutical supply chain.

3 - Managing Outpatient Appointments via Choose-and-Book

Houyuan Jiang, Cambridge University, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, h.jiang@jbs.cam.ac.uk, Sergei Savin, Zhan Pang

Choose and Book is a national electronic referral system for outpatient appointments in England. Choose and Book is instrumental in helping to measure and manage the 18-weeks pathways. We propose a dynamic control model to help the service provider to manage appointment time slots. We identify a simple and optimal threshold policy and conduct comparative statics analysis. Our analysis reveals the trade-off between the waiting time target and choice and explains what happens in practice.

■ TB58

H-Room 309, Third Floor

Modern Problems in Scheduling

Cluster: Scheduling
Invited Session

Chair: Marc Posner, Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, posner.1@osu.edu

1 - Appointment Scheduling and Applications
Mehmet Begen, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, mbegen@ivey.uwo.ca, Maurice Queyranne

We determine optimal appointment dates in polynomial time for a given sequence of jobs on a single processor to minimize the expected total underage and overage costs when jobs have random processing durations given by a joint discrete probability distribution. There are many important real-life applications for appointment scheduling, such as surgery scheduling, physician appointments, gate and runway scheduling of aircrafts in an airport.

2 - Rescheduling for Machine Disruption
Zhixin Liu, Assistant Professor, College of Business, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu, Young Ro

We consider scheduling problems where jobs have been scheduled when the machine becomes unavailable for a period of time. The disruption is measured by the maximum time deviation of any job from the original schedule. Our model minimizes a total cost objective subject to a limit on the disruption. For each of the four cost objectives considered, we provide a computationally efficient optimal algorithm, a fully polynomial time approximation scheme, and a general approximate solution procedure.

3 - Time-constrained Project Scheduling with Adjacent Resources
Johann Hurink, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, J.L.Hurink@utwente.nl, Leendert Kok, Jacob Jan Paulus, Marco Schutten

We develop a decomposition method for the Time-Constrained Project Scheduling Problem (TCPSP) with Adjacent Resources (AR). For AR, units are ordered and units assigned to jobs have to be adjacent. AR's are not required by single jobs, but by job groups. The AR-units are occupied from the start of the first up to the completion of the last job of the group. The developed decomposition method separates the AR assignment and the scheduling. Test results show the applicability of the method.

4 - A Unified Approach to the Measurement of Approximation Error
Nicholas Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall.33@osu.edu, Marc Posner

We develop a meta-theory to select measures to evaluate heuristic performance. The purpose and application define a set of requirements for a measure. Additional requirements are defined by the need for measure stability under various changes in data. Our methodology identifies conditions for the use of four possible error measures. It links application types, requirements for measurement metrics and for stability, and various error measures. We illustrate our methodology with case studies.

■ TB59

H-Room 310, Third Floor

Tutorial: Logistics and Transportation in Global Supply Chains - Review, Critique and Prospects

Cluster: Tutorials
Invited Session

Chair: James H Bookbinder, Professor, University of Waterloo, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, jbookbinder@uwaterloo.ca

Co-Chair: Tiffany A. Matuk, University of Waterloo, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, tamatuk@uwaterloo.ca

1 - Logistics and Transportation in Global Supply Chains - Review, Critique and Prospects
James H Bookbinder, Professor, University of Waterloo, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, jbookbinder@uwaterloo.ca, Tiffany A. Matuk

Logistics and transportation are paramount for a supply chain whose nodes are in different areas of the world. We review a number of research papers that emphasize activities distinguishing global supply chains. Supplier selection is also important domestically, but now involves border crossings and exchange rates. Switching production between countries, say, is uniquely international and depends upon tariffs, quotas and local content restrictions. We will discuss logistics for NAFTA and the EU.

■ TB60

H-Room 311, Third Floor

Applications of SDP to EDM and Other Polynomial Optimization Problems

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Henry Wolkowicz, University of Waterloo, Dept of Comb and Opt, Waterloo, ON, N2L 3G1, Canada, hwolkowi@uwaterloo.ca

1 - Universal Rigidity: Towards Accurate and Efficient Localization of Wireless Networks
Yinyu Ye, Professor, Stanford University, 316 Terman Engineering Building, Stanford, CA, 94305, United States of America, yinyu-ye@stanford.edu, Anthony Man-Cho So, Zhisu Zhu

We propose a notion of universal rigidity that captures a large class of wireless networks and is much more relevant to the efficient solvability of network localization problems. We give various constructions of universally rigid instances. We also apply our results to design a novel edge sparsification scheme that can reduce the size of the input network while provably preserving its original localization properties.

2 - Exploiting Sparsity in SDP Relaxation for Sensor Network Localization
Hayato Waki, Dr., The University of Electro-Communications, Chofugaoka, Chofu-Shi, Tokyo, 182-8585, Japan, hayato.waki@jsb.cs.uec.ac.jp, Masakazu Kojima, Sunyoung Kim

We present a sparse variant of the Biswas-Ye SDP relaxation for sensor network localization problems. We compare numerically the Biswas-Ye SDP relaxation, its sparse variant, and the edge-based SDP relaxation by Wang et al. to confirm the effectiveness of the proposed techniques for exploiting sparsity in SDP relaxation for sensor network localization problems. The sparse variant of the Biswas-Ye SDP relaxation outperforms all other SDP relaxations in speed.

3 - On SDP and ESDP Relaxations for Sensor Network Localization
Paul Tseng, Dept of Mathematics, University of Washington, Seattle, United States of America, tseng@math.washington.edu, Ting Kei Pong

We study SDP and ESDP relaxations for ad hoc wireless sensor network localization. In particular, we propose a noise-aware version whose solution set is more robust in the presence of noisy distance measurements. We also propose an efficient distributed method to find an interior solution.

4 - Explicit Sensor Network Localization Using Semidefinite Programming and Clique Reductions
Henry Wolkowicz, University of Waterloo, Dept of Comb and Opt, Waterloo, ON, N2L 3G1, Canada, hwolkowi@uwaterloo.ca, Nathan Krislock

The sensor network localization, SNL, problem consists of locating the positions of sensors, given only the distances between sensors that are within radio range and the positions of some fixed sensors (called anchors). By finding explicit representations of the faces of the SDP cone corresponding to unions of cliques of the SNL problem, we derive a preprocessing technique that solves the SNL problem, with exact data, by explicitly solving the corresponding SDP problem.

■ TB61

H-Room 312, Third Floor

Logistics

Contributed Session

Chair: Rafay Ishfaq, University of Alabama, 300 Alston Hall, Tuscaloosa, AL, United States of America, rishfaq@cba.ua.edu

1 - Design and Evaluation of Production Concepts for Modular Car Architectures
Marcel Helmdach, University of Paderborn, Deichsberg 9, Paderborn, 33106, Germany, marcel.helmdach@hni.uni-paderborn.de

Fords Model T was offered in just one standard type, but since then, the diversity of variants which car manufacturers offer has increased tremendously, resulting in high complexity costs for production and logistics. One possibility to handle this complexity and cut costs is modularization, meaning the outsourcing of a part of the production process from the main assembly line to sub assembly lines or suppliers. This presentation shows how OR can be used to find and evaluate suitable modules.

2 - Benefits and Challenges of GIS/GPS Application in Emerging Markets

B Zhou, CBPA, Kean University, 1000 Morris Ave, Union, NJ, 07083, United States of America, bzhou@kean.edu, H Zhong

We study the application of GPS/GIS technologies in logistic operations in emerging markets. As part of a bigger project, the study reveals some interesting preliminary results and demonstrates major benefits as well as limitations and challenges in the implementation process.

3 - Convex Bernstein Polynomial Approximation on the Stochastic Resource Allocation Problem

Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr., Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

We propose to solve large scale network resource allocation problem with stochastic demands by fitting the expected objective by a sequence of convex polynomials with non-negative coefficients and thereafter apply Newton's method on it. We apply a Weierstrass-like theorem and showed that if we can evaluate the expected appraisal function, we will reach the arbitrary optimal by solving the new problem. When experimental errors exist, we have the probabilistic convergence instead.

4 - Logistics Issues in Intermodal Hub Networks

Rafay Ishfaq, University of Alabama, 300 Alston Hall, Tuscaloosa, AL, United States of America, rishfaq@cba.ua.edu, Charles Sox

This research highlights the role of intermodal logistics within the modern supply chains. Modeling non-linear transportation costs, fixed location costs, modal connectivity costs and service time requirements, an intermodal (road, rail and air) logistics hub network is designed. In light of discussions with industry professionals and using real world data, this research develops managerial insights into the operational, financial and service performance of intermodal logistic networks.

■ TB62

H-Room 313, Third Floor

Behavioral Research in New Product Development

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Enno Siemsen, Assistant Professor, University of Minnesota, 1209 S. Sixth Street, Minneapolis, MN, 55405, United States of America, siems017@umn.edu

1 - Decentralized Balancing of Complementary Tasks

Enno Siemsen, Assistant Professor, University of Minnesota, 1209 S. Sixth Street, Minneapolis, MN, 55405, United States of America, siems017@umn.edu

In a centralized process, much is known how to balance the workload among different workstations. Less is known about how to balance the effort of team members working on complementary tasks in a decentralized ëwhite collar' environment. We therefore explore different mechanisms of how to achieve balance in the team and find that there is a trade-off between designing effective (i.e. productivity enhancing) and fair incentives.

2 - Diverse Preferences as a Source of Systematic Project Evaluation Biases

Nektarios Oraiopoulos, Judge Business School, University of Cambridge, Trumpington Street, Cambridge, United Kingdom, n.oraiopoulos@jbs.cam.ac.uk, Stylianos Kavadias

New Product development teams are often prone to two types of errors: terminating too early a project that would have been successful or continuing a project that eventually fails. Our work studies how the corresponding probability for each type of error changes as the NPD team becomes more diverse. The latter is captured by the dispersion that team members exhibit with respect to either their prior project evaluations or to their interpretive biases of new information.

3 - Complexity, Screening and Allocation Bias in R&D Pipelines

Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu, Paulo Figueiredo, Paulo Goncalves

We explore tradeoffs associated with key R&D pipeline management decisions in the presence of an allocation bias: either adding to the number of starts or selecting more complex projects and screening out a fraction of projects midway through the pipeline. We derive analytical conditions on the stability of the portfolio performance and use these conditions to compare alternative incentive schemes. We conclude by illustrating how these conditions can be tested experimentally.

4 - Antecedents and Consequences of Client-vendor Conflict in Distributed Project Organizations

Anant Mishra, University of Minnesota, Carlson School of Management, 321-19th Avenue S, Minneapolis, United States of America, mish0049@umn.edu, Kingshuk Sinha

As technology projects become increasingly distributed within and between firm and country boundaries, managing conflict between a client and the vendor in such projects has become critical to their effective execution. Using primary data from 830 technology projects, we examine the antecedents and consequences of client-vendor conflict (relationship conflict and task conflict) across four types of project organization (Insourcing, Outsourcing, Offshoring, and Offshore-Outsourcing).

■ TB63

H-Room 314, Third Floor

Modeling and Optimization in Health Care

Contributed Session

Chair: Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu

1 - A System Approach for Uncertainty Modeling in Clinical Laboratory Measurements

Varun Ramamohan, Graduate Student (PhD), Department of Industrial Engineering, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States of America, vramamoh@purdue.edu, Vishal Chandrasekar, George Klee, Jim Abbott, Yuehwern Yih

Systematic errors in laboratory measurements have significant impact on clinical decisions, patient safety and medical costs. A system approach towards quality control of clinical laboratory measurements is described in this paper. We present a calibration model that identifies the sources of systematic error and then systematically analyzes the propagation of these errors throughout the process. Monte Carlo simulation is used to derive the general uncertainty measure for this bias.

2 - Modeling the Treatment-prevention Tradeoff

George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org, Matt Daly

It is frequently claimed "with little quantitative evidence" that current health care expenditures inappropriately emphasize treatment over prevention. We are investigating this assertion using a dynamic model of the impacts of alternative investments in treatment and prevention, and in research to develop new treatment and prevention interventions, on effectiveness (measured in quality adjusted life years). We describe the structure of the model and emerging results from its application.

3 - Radiation Quality Assurance with DICOM Information

Shanshan Wang, PhD Student, Arizona State University, School of CIDSE, Tempe, AZ, 85281, wshanshan@asu.edu, Teresa Wu, Muhong Zhang, Mary B. Peter, Richard L. Morin, Steve Langer, Catherine C. Roberts, William Pavlicek, Beth A. Schueler

The oversight and monitoring of radiation dose use are required in federal and state statutes. Digital Imaging and Communications in Medicine (DICOM) standards is a widely adopted standard in radiation imaging processing. In this study, we build an information system to capture the information in DICOM compliant radiation images and explore their use in routine quality assurance activities. The system consists of a knowledge base of known devices (i.e. modalities), a patient episode dose tracking database and a set of web-based reporting tools. The implementation potentially provides quantitative data hints to reduce radiation exposure and automates the radiation regulatory compliance process.

4 - The When Diet: Mathematically Optimizing Eating and Exercise for Weight Loss

Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu

Over the past five years I have studied the dieting problem and recently published The When Diet: Mathematically Optimizing Eating and Exercise for Weight Loss. This talk presents the major developments contained in this book, including a mathematical proof of The When Diet, the stochastic properties of hunger, lean manufacturing and how to minimize the misery incurred by being on a diet while maximizing the amount of weight lost.

■ TB64

H-Room 202A, Second Floor

Business Analytics in the Business School

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Curt Hinrichs, Manager, JMP Academic Programs, SAS Institute, One Montgomery Street, 34th floor, San Francisco, CA, 94104, United States of America, Curt.Hinrichs@sas.com

Co-Chair: Jerry Oglesby, SAS, Jerry.Oglesby@sas.com

1 - Bringing MBA Students and Practitioners Together Through Analytics

Russell Walker, Northwestern University, Kellogg School of Management, Evanston, IL, United States of America, russell-walker@kellogg.northwestern.edu

Over the last few years, we have seen a strong interest by recruiters in MBA talent that possesses not only strong business skills, but advanced quantitative skills. The classic MBA curriculum provides core courses in statistics and decision making, and with select electives, many students develop advanced quantitative skills. At the Kellogg School of Management, experiential learning is a pillar of the learning process. This talk describes the formulation of the Analytical Consulting Lab, an experiential course that brings together MBA students with companies on real-world problems, where the focus is on analytics.

2 - Teaching Data Warehousing, Business Intelligence, Data Mining From Business Strategy Point of View

Arif Ansari, Assistant Professor of Clinical in IOM, University f Southern California, Marshall Schol of Business, 3670 Trousdale Parkway, BRI 401, Los Angeles, CA, 90087, United States of America, aansari@usc.edu

In this paper, we will show teaching business strategy first and then discussing the three different tools is better. We will discuss the current strategies in business today and show it can be enabled by the combination of all the three topics. The paper will discuss how the understanding of the business strategies enable the students to capture key variables in the business processes, design better Warehouses, build better Business Intelligence tools and develop appropriate data mining models.

3 - Business Plus Intelligence Plus Technology Equals Business Intelligence

Ron Klimberg, Professor, Saint Joseph's University, 5600 City Avenue, Philadelphia, PA, 19131, United States of America, klimberg@sju.edu, Ira Yermish, Virginia Miori, John Yi, Rashmi Malhotra

Over the last decade or so, a seemingly new discipline called business intelligence has emerged. While there are several professional/consulting organizations few universities have adapted their research, academic programs and their organizational structures to adapt to this change. We will argue that we are seeing a fundamental change in the organizational approach to the disciplines that have fed into contemporary business intelligence and resulting in a change in our academic programs.

4 - Data Mining with JMP

Tom Bohannon, Higher Education Consultant, SAS Global Academic Program, SAS Campus Drive, Cary, NC, 27513, United States of America, tom.bohannon@sas.com

Data mining can be defined as advanced methods for exploring and modeling relationships in large amounts of data. The emphasis will be on data mining for predictive modeling with a binary target. These concepts and data mining tasks will be illustrated using JMP, a SAS product. A large part of the presentation will be on using JMP's partition platform (decision tree) partition platform enables users to systematically analyze large data sets to discover unsuspected or unknown relationships.

■ TB65

H-Room 202B, Second Floor

WORMS Keynote Session

Sponsor: Women in OR/MS
Sponsored Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, Terman Enineering Center, Room 305, Stanford, CA, 94305, United States of America, ferhun@stanford.edu

1 - From Venn Diagrams to Public Health Policy: An OR Journey

Margaret Brandeau, Professor, Stanford University, 407 Terman Engineering Center, MS&E Department, Stanford, CA, 94305, United States of America, brandeau@stanford.edu

How can you carve out a successful career in OR? Can you have it all? Do you even want to have it all? How is the OR/MS profession evolving? In this talk I will describe my OR journey, from undergraduate math major to professor of management science and engineering. I will reflect upon my research career and personal experiences along the way.

■ TB66

H-Room 204A, Second Floor

Real Options in Operations Management

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu

1 - Exploring and Exploiting the Value of Clicks in Operations Management

Tingliang Huang, Ph.D. Candidate, Kellogg School of Management, Northwestern University, Leverone 529, Jacobs Center, 2001 Sheridan Road, IL 60208, Evanston, IL, 60208, United States of America, tingliang-huang@kellogg.northwestern.edu, Jan Van Mieghem

Recent Internet clicks-tracking technology allows firms to know who is visiting their website and gather visitors' online click behavior. First, using clicks and actual sales data, we provide empirical evidence that clickstream data can be used as imperfect advance demand information (ADI) to predict future demand in an offline transaction setting. Second, assuming a firm can use clicks as ADI, we study whether strategic/myopic consumers have an incentive to visit the website.

2 - Incentive Outsourcing Contracts for Technology Adoption: A Principal Agent Perspective

Baichun Feng, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, buf118@psu.edu, Tao Yao, Bin Jiang

In this study, we analyze how the client can promote the vendor to adopt a new green technology via an incentive outsourcing contract. Such contract is based on investment timing where agency conflicts and information asymmetries occur. Incentives are provided by the client to the vendor to incur costly effort and truthfully disclose private information. We show how to derive the optimal outsourcing contract and the effect of agency issues.

3 - Outsourcing Contract Selection and Timing Decision

Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Susan Xu, Yongma Moon, Bin Jiang

This talk discusses how a pre-outsourcing firm facing uncertain operating costs selects the outsourcing contract and decides the outsourcing timing. We develop a real options model to investigate this firm's choice between a fixed-price contract and a cost-plus contract. Our results may help managers gain a better understanding of the closely intertwined relationship between the contract type and contract timing, so that make appropriate outsourcing decisions.

■ TB67

H-Room 204B, Second Floor

DEA in Banking and Investment

Cluster: Data Envelopment Analysis
Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu

1 - A Mean-variance Efficiency Approach to Efficient Resource Allocations

Chien-Ming Chen, Postdoctoral scholar, Center for Corporate Environmental Performance, UCLA Institute of the Environment, La Kretz Hall, Suite 300, Box 951496, Los Angeles, United States of America, cmchen@ioe.ucla.edu, Joe Zhu

This paper proposes an intergraded approach to single-stage resource allocations, in which we consider the mean-variance trade-off of productive efficiency among allocation portfolios. In this paper, we develop a new efficiency index and its bootstrap algorithm, whose outputs are used to estimate parameters in the allocation model. To illustrate we apply our approach to an empirical R&D project budgeting problem. This paper presents a novel application of the efficiency bootstrap method.

2 - Profit Efficiency and Return on Equity in Banking: Evidence From Indian Data

Kankana Mukherjee, Assistant Professor, Babson College, Economics Division, 231 Forest Street, Babson Park, MA, 02457, United States of America, kmukherjee@babson.edu, Subhash Ray, Abhiman Das

In this paper we provide a decomposition of return on equity (ROE) that examines the role of profit efficiency as one of its several components. Our decomposition also captures the role of risk and solvency, among other factors, in determining the ROE. We use Data Envelopment Analysis (DEA) to measure profit efficiency and apply the proposed decomposition using data from individual Indian banks of different ownership categories for the period 1997-2003.

3 - Sustainability Assessment of Venture Business Firms

Chang Won Lee, Operations and Service Management, School of Business, Hanyang University, Seoul, 133-791, Korea, Republic of, leecw@hanyang.ac.kr, N. K. Kwak

An appropriate assessment of sustainability in venture business is an important managerial and investment decision making. Data envelopment analysis is utilized for sustainability assessment for venture business firms' performance. Required information for this study is collected from Korea Listed Companies Association database. The proposed model provides decision-makers with more accurate information for strategic insights in order to make better investment decisions.

■ TB68

H-Room 206, Second Floor

OR Practice in INFORMS Roundtable Companies

Sponsor: CPMS, The Practice Section

Sponsored Session

Chair: Arnold Greenland, Distinguished Engineer, IBM, 6710 Rockledge Drive, Bethesda, MD, 20817, United States of America, agreenland@us.ibm.com

1 - Optimization Applications at SAS Institute

Manoj Chari, Director, Operations Research R&D, SAS Institute, 100 SAS Campus Drive, Cary, United States of America, Manoj.Chari@sas.com

Operations Research has been a key area of R&D investment as SAS Institute has embarked on a long term strategy to expand its portfolio of offerings to include problem-specific business applications and industry solutions. This talk will highlight a few instances of such applications and solutions in which optimization plays a crucial role.

2 - Improving Operations at GE

Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

Over the past 15 years General Electric (GE) Global Research Center has developed a number of optimization algorithms and decision support systems that are currently in use across GE. In this talk, I will present a brief overview of some of this work.

3 - The Practice of OR/MS inside Intel Corporation

Karl Kempf, Intel Corporation, 5000 W. Chandler Blvd., MS-CH3-10, Chandler, AZ, 85226, United States of America, karl.g.kempf@intel.com

The Decision Engineering Group at Intel has been active for 22 years and has developed decision support tools for most divisions of the company using many different OR/MS techniques to solve a wide spectrum of business problems. We have learned valuable lessons, usually the hard way. This talk is about what you need to know to successfully develop and deploy successful OR/MS application in addition to the math.

■ TB69

H-Indigo A, Second Floor

Single Machine Scheduling

Contributed Session

Chair: Stefan Bock, Professor, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42097, Germany, sbock@winfor.de

1 - The Comparison of Permutation Genetic Algorithm Crossover Operators

Zuhal Kartal, Research Assistant, Anadolu University, Industrial Engineering Department, Eskisehir, Turkey, zkartal@anadolu.edu.tr, Gokhan Kirlik

The single machine total weighted tardiness problem with sequence dependent setup times is a challenging and heavily studied problem. In literature, different solution methods are used to solve this problem. One of them is genetic algorithm (GA) which has lots of operators. The most important operator of GA is crossover operator. This operator affects the solution quality. In this study, the performance of permutation type crossover operators is compared for this problem with benchmark problems.

2 - An Evolutionary Algorithm for Machine Scheduling Subject to Inventory Constraints

Dirk Briskorn, Christian-Albrechts-Universitaet, Olshausenstr. 40, Kiel, 24098, Germany, briskorn@bwl.uni-kiel.de

We consider inventory constraints in a single machine environment. Here, jobs add and remove items to an inventory and from an inventory, respectively. Jobs removing items cannot be processed if the required amount of items is not available. We consider problems on a single machine with the objective functions common in machine scheduling and develop a GA framework to solve them. We outline concept of the algorithm as well as computational results.

3 - Minimizing Sequence-dependent Setup Costs under Due Date Restrictions

Stefan Bock, Professor, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42097, Germany, sbock@winfor.de, Kathrin Klamroth

In this paper the minimization of sequence-dependent setup costs under due date restrictions is addressed. Analogously to the approach of Gilmore and Gomory, setup costs are assumed to be proportional to absolute state differences. We show that the integration of due dates leads to a strongly polynomial problem if the number of setup states is a constant. By making use of new dominance rules, problem instances of larger size can be solved optimally by a best-first Branch&Bound procedure.

■ TB75

C-Room 32A, Upper Level

Railroad Capacity Planning Session II

Sponsor: Railroad Applications

Sponsored Session

Chair: Clark Cheng, Sr. Manager Operations Research, Norfolk Southern Corp., 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, Clark.Cheng@nscorp.com

1 - Evaluating the Impact of Advanced Railway Technologies on Line and Network Capacity

Yung-Cheng Lai, Assistant Professor, National Taiwan Universtiy, Rm 313, Civil Engineering Bldg, No 1, Roosevelt Rd, Sec 4, Taipei, 10617, Taiwan - ROC, yclai@ntu.edu.tw, Mark Dingler, Christopher P.L Barkan, Sofi Chiang

In this research, we aim to identify advanced operating technologies, such as PTC and ECP brakes, with the potential to positively affect network capacity, and then develop analytical tools and conduct analyses to quantify the capacity benefits of various possible scenarios. This will provide railroads with a method to evaluate and quantify the potential benefits and help them determine the most cost effective plan for adopting these new technologies to meet future demand.

2 - Investigating the Impact of Train Type Heterogeneity on Railroad Capacity Using Simulation Modeling

Mark Dingler, Graduate Research Assistant, University of Illinois at Urbana-Champaign, B118, Newmark Lab., 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, dingler2@illinois.edu, Yung-Cheng Lai, Christopher P.L Barkan

Efficient planning of new railroad capacity requires understanding how operational practices affect capacity and heterogeneity in train and traffic characteristics is a key aspect of railway operations. Train dispatching simulation software was used to analyze the effect of heterogeneity in train speed, power to ton ratio and priority on traffic delay and the effectiveness of certain operating strategies that may reduce these delays.

3 - Railway Dispatching with Perfect Delay Information

Steven Harrod, Assistant Professor, University of Dayton, 300 College Park, Dayton, OH, 45469, United States of America, steven.harrod@udayton.edu

An optimal schedule is derived for a mixed traffic railway network using a discrete time multicommodity flow model. Solutions are generated without delays, and with advance information of delays. The impact of the stochastic delays on system utility and dispatch strategy is discussed.

4 - Integrating Steady State and Dynamic Rolling Stock Models with Cyclical Demand

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

Transportation companies position rolling stock (e.g., containers, locomotives) where it will be needed in the face of weekly cyclical demand pattern. Locations have target levels for rolling stock supply based on strategic, steady state models. In a stochastic tactical setting, deviations from the strategic steady state targets are common. We look at optimal recovery paths to the steady state target levels and the integration of steady state and dynamic models.

Interactive Session

Tuesday, 12:30pm - 1:30pm

Exhibit Hall

1 - A Case Study for Analysis of the Cost Change in Construction Risk Management

Omer Faruk Baykoc, Gazi University, Maltepe, Ankara, 06570, Turkey, baykoc@gazi.edu.tr, Veysel Sinan Yuzbasi

This study aimed at comparing the possible effects of the demand changes which can be executed in abode construction projects on the project planning. The risk related with the workload increase of the demand changes in abode construction projects to different neighborhoods was examined via PERT and analyzed via cash flow method. To this end, the risk of earlier completion of two different projects was analyzed, the cash flows of revenues and expenses were compared and interpreted by NPV method.

2 - A Framework for Estimation of Configurable Product Substitution Rates: Application to Auto Markets

Dingzhou Cao, GRA, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, dcao@wayne.edu, Ratna Babu Chinnam, Alper Murat

High product substitution rates and product configurability in automotive market presents inventory management challenges. We propose a framework for estimating vehicle substitutions based on 'option' differences and apply it to automotive market. The model is based on maximum likelihood approach and employs a Markov Blanket scheme to manage model complexity.

3 - A Hybrid Meta-heuristic Approach to Design of Reliable Networks

Fulya Altiparmak, Professor Dr., Gazi University, Faculty of Engineering and Architecture, Maltepe, Ankara, 06570, Turkey, fulyaal@gazi.edu.tr, Berna Dengiz, Onder Belgin

This study presents a hybrid meta-heuristic approach based on particle swarm optimization (PSO) and simulated annealing (SA), PSO_SA, to design of communication networks with minimum cost under all-terminal reliability constraint. In order to investigate the effectiveness of the PSO_SA, comparisons with other heuristic approaches, which are proposed for the design problem, are carried out. Computational results show that PSO_SA is an effective heuristic approach to design of reliable networks.

4 - A Manufacturing and Remanufacturing Aggregate Planning Model with a Non-linear Supply Function

Jordi Olivella, Associate Professor, Technical University of Catalonia, Edifici C3. Despatx 101, C. Esteve Terradas, 5, Castelledefels, 08860, Spain, jorge.olivella@upc.edu, Amaia Lusa, Albert Corominas

A mathematical programming model is proposed for aggregate planning considering manufacturing of new units and remanufacturing of used ones with indistinguishable final products. The recovered units may have different used conditions. A non linear relation between the price offered to the customers for the used units ant the proportion of used units that are recovered is considered. The optimal price at each planning period is determined by the model.

5 - A Proposed Knowledge Sharing Platform

Albert Cruz, Instructor, National University, 3678 Aero Court, San Diego, CA, 92123, United States of America, acruz@nu.edu, Jonathan Ng

The proposed platform utilizes a hybrid of EMS (electrical meeting system) and social networking to overcome the fundamental barriers of knowledge sharing. Various existing knowledge sharing environments are examined and evaluated in terms of (a) quality, (b) ratio of content contributors to passive members, and (c) ease of future retrieval.

6 - BioDE: A Novel Differential Evolution Approach for Molecular Conformational Search

Athina Brintaki, PhD Candidate, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, 33620, United States of America, abrintak@mail.usf.edu

This research poster proposes a new scheme called Biological Differential Evolution (BioDE) to minimize the molecular energy based on a differential evolution algorithm and our previously developed data structure called geBGF. The proposed BioDE utilizes the geBGF approach as a surrogate approximation model to reduce the number of exact evaluations and hence, to speed molecular conformational search and to reduce the algorithm's convergence rate.

7 - HOPSPACK Software Framework for Parallel Derivative-free Optimization

Todd Plantenga, PMTS, Sandia National Laboratories, 7011 East Ave, Livermore, CA, 94550, United States of America, tplante@sandia.gov

HOPSPACK (Hybrid Optimization Parallel Search PACKage) solves derivative-free optimization problems using an open source C++ framework. The framework enables parallel operation using MPI and multithreading. Multiple algorithms can be hybridized to run simultaneously, sharing a cache of computed objective and constraint function evaluations that eliminates duplicate work. HOPSPACK comes with a Generating Set Search algorithm, and is easily extended by developers to add new algorithms.

8 - Large Problems and Small Problems

Mark Spearman, President, Factory Physics, Inc., 3600 E. 29th, Bryan, TX, 77802, United States of America, spearman@factoryphysics.com

We address the large problems facing manufacturing supply chains: what is the optimal capacity, inventory, service level to customers, lead times, and what should be made to order as opposed to stock? These "large" problems can be addressed by considering a single smaller but more difficult problem that is non-linear, integer, and not always convex. We present methods to address the problem and results from industry in an interactive session using web-based software.

9 - Large Scale Evacuation of Carless People: A Tabu Search Algorithm for Bus Routing Problem

Chi Pak Chan, PhD Student, ATLAS Center, University of Arizona, P.O. Box 210020, Tucson, AZ, 85721-0020, United States of America, cpchan@email.arizona.edu, Mark Hickman

We consider the large-scale evacuation of carless people under short- and long-notice disasters. Assuming the carless are congregated at evacuation sites in the affected area, and number of carless at each evacuation site is known. A Tabu Search algorithm has been developed to produce itineraries of buses to pick up the carless at the evacuation sites and deliver them at safe locations, with an objective to maximize the number of carless evacuated within the given time limit for evacuation.

10 - Model-based and Optimizing Design Methodology for Production Systems

Petri Eskelinen, University of Jyväskylä, P.O. Box 35 (Agora), University of Jyväskylä, FI-40014, Finland, petri.a.eskelinen@jyu.fi, Sauli Ruuska

We introduce a project where new model-based and optimizing design methodology for material and information flows in production systems is being developed. The overall aim is to increase flexibility in process design and reduce capital employed in production lines. The main application area is pulp and paper industry.

11 - On an Analysis of Scheduling for Virtual Manufacturing Cells: Batch Splitting

Zulal Gungor, Professor, Gazi University, Gazi Uni. Industrial Eng. Dept., Maltepe, Ankara, 06570, Turkey, zulalg@gazi.edu.tr, Saadettin Kesen

For scheduling Virtual Manufacturing Cells, We developed two Mixed Integer Programming formulations, one of which is with batch splitting. Makespan and total travelling distance are objectives. On a wide range of test problems, we run two models and results show that batch splitting provides better system results while increasing scheduling complexity.

12 - Optimizing Screening for Colorectal Cancer Prevention and Surveillance

Fatih Safa Erenay, University of Wisconsin Madison, 501 N Midvale Blvd Apt C, Madison, WI, 53705, United States of America, erenay@wisc.edu, Oguzhan Alagoz

Colorectal cancer (CRC) can be prevented or early-detected via CRC screenings. We develop a finite-horizon POMDP model in order to obtain the optimal colonoscopy screening policy for the objective of maximizing total expected quality-adjusted life-years. Ours is the first analytical model considering both CRC prevention and surveillance using clinical data.

13 - Planning Tools for Program Management in a Supply Chain Context

Suri Gurumurthi, PhD Candidate / Instructor, Duke University Fuqua School of Business, 1 Towerview Road, Box 90120, Durham, NC, 27708, United States of America, sg61@duke.edu

Programs are often are conceived, planned, and executed within a supply chain context. Defining and allocating program tasks or roles across the set of firms, and managing the program related objectives of a diverse collection of resource groups is therefore a central challenge for many supply chains. Using well known cases and examples, we highlight some evolving models, frameworks and tools to help supply chains manage and control their critical programs.

14 - The Potential of Multi-player Agent-based Simulations in the Modeling of Complex Service Systems

Natalie Simpson, Assoc. Professor, University at Buffalo (SUNY), 351 Jacobs Management Center, Buffalo, NY, 14052, United States of America, nsimpson@buffalo.edu, Philip Hancock

Agent-based modeling stresses the representation of systems as sets of distinct autonomous agents, behaving and interacting according to locally available information. Multi-player virtual reality environments allow the incorporation of authentic human agents into otherwise computational simulations, as demonstrated with the modeling of an existing emergency room in this pilot study.

15 - Observability and Sensor Placement for Advanced Power Systems

Adrian Lee, University of Illinois, 201 N. Goodwin Ave, Urbana, IL, 61801, United States of America, ajlee4@illinois.edu, Urmila Diwekar

Obtaining a network of optimal sensor locations for advanced power systems involves both maximizing cost effectiveness and minimizing environmental impacts. Preliminary work is presented in establishing an observability measure for nonlinear chemical processes under uncertainty, based on Fisher information, to simultaneously address the sensor placement and parameter identification problems.

16 - Modeling the Physician Preference Item Supply Chain

Cara Dienes, Iowa State University, 3038 Black Engr., Ames, IA, 50014, United States of America, cdienes@iastate.edu, John Jackman

Physician preference items are a key component of healthcare supply costs. This work models the device manufacturer, physician, and hospital roles in the physician preference item procurement process, in order to learn how the unique characteristics of this supply chain, such as a lack of price transparency and a high rate of technological change, may impact costs.

17 - Physiological Aspects of Load Encumbrance in an Agent Based Force-on-force Constructive Simulation

Mitha Andra, Technology Solutions Experts,Inc., 203 West Central Street, Natick, MA, 01760, United States of America, mitha.andra@gmail.com, Dan Rice

The research goal is a comparative assessment of the impact of systems/equipment/clothing on human task performance as represented in the Infantry Warrior Simulation (IWARS). We consider a variety of modeling challenges and physiological interactions. The initial implementation is a model predicting sustainable energy expenditure, subjected to equipment load, for movement related tasks. Future work will include other encumbrances (e.g. cognitive) on soldier task performance.

18 - AMHS Scheduling in Semiconductor Manufacturing

Emrah Zarifoglu, PhD Candidate, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, zarifemrah@gmail.com, John Hasenbein, Erhan Kutanoglu

Full automation of manufacturing operations in the semiconductor industry has brought new challenges to material handling in wafer fabrication. Scheduling AMHS in a wafer fab has become a significant factor in order to achieve cycle time reductions by synchronizing AMHS operations with production activities. We analyze current myopic AMHS decision making models and search possible benefits of known information on AMHS scheduling using analytical modeling and optimization.

19- Markovi - An Interactive Approach to Learning Markov Chain Analysis

Daniel Silva, OR Sr. Analyst, Kimberly Clark Corp., Cra. 11A # 94-25 P5, Bogota, Colombia, daniel.f.silvaizquierdo@kcc.com, German Riano

Markovi is a didactic spreadsheet application which allows students to easily visualize, simulate and solve discreet time Markov chains. The user inputs the transition matrix and initial conditions vector, Markovi constructs the transition diagram, reports steady state probabilities, absortion probabilities and allows step by step simulation of the Markov chain.

20 - Sum of Squares and Polynomial Convexity

Amir Ali Ahmadi, MIT, 195 Binney st., Apt. #4401, Cambridge, MA, 02142, United States of America, a_a_a@mit.edu

The algebraic notion of sos-convexity has recently been proposed as a sufficient condition for convexity of polynomials based on semidefinite programming. Motivated by its computational tractability, it has been speculated whether sos-convexity is also a necessary condition for convexity of polynomials. In this paper, we give a negative answer to this question by presenting an explicit example of a trivariate homogeneous polynomial of degree eight that is convex but not sos-convex.

21 - Research Agenda on Integrated Hospital Material Management

Vesa Kamarainen, TKK, Helsinki University of Technology, P.O. Box 9500, Espoo, Finland, vkama@cc.hut.fi, Antti Peltokorpi, Karita Reijonsaari, Ann-Marie Turtiainen

Healthcare material logistics is widely discussed in academic literature but only little attention is paid to integrated material management (IMM).Inventory management, deliveries to wards and ward logistics have been seen as separate activities inside hospital.It means increased costs, but has also impacts on care process due to the long waiting times and incorrect material deliveries. We present a research agenda on IMM based on our hospital pilot project data in Helsinki metropolitan area

22 - An Empirical Study on IT-enabled Supply Chain Value Co-creation

Yao Zhang, Georgia Institute of Technology, Graduate Living Center, 10th Street NW, Atlanta, United States of America, zhangyao@gatech.edu, Lih-Bin Oh, John Talbot

Enterprises across industries are adopting new IT systems to facilitate collaborative relationships with external partners to achieve supply chain-wide competitive advantages. Based on an empirical investigation of a global FMCG's new web-based multi-firm IT implementation in a developing country, this study expands the current trajectory of IT value research by examining IT-based value co-creation among multiple supply chain network parties.

23 - New Preference Models and Optimization Methods for Complex Decision Problems with Multiple Criteria

Alexander Engau, Assistant Professor, University of Colorado Denver, Mathematical and Statistical Sciences, Campus Box 170, PO Box 173364, Denver, CO, 80217-3364, United States of America, aengau@alumni.clemson.edu

To recover and foster economic and technological prosperity, decision-makers today can highly benefit from new advances that enhance the development of mathematical models, optimize the computation of candidate alternatives, and facilitate the choice of preferred efficient solutions. Summarizing our contributions to cone-based preference models and multicriteria optimization, we highlight their significance on applications in structural engineering, vehicle layout, and financial risk management.

24 - Translating Inventions into Products: Inventors' Educational Background and Speed of Licensing

Ayfer Ali, PhD Candidate, Harvard University/HBS, 44 HBS Mail Ctr, Boston, MA, 02163, United States of America, aali@hbs.edu

The increased amount of funding that goes into 'translational research' emphasizes the need for interdisciplinary and multidisciplinary research and the training of interdisciplinary researchers, specifically MD/PhDs. I use invention and patent data from three large Academic Medical Centers to understand whether the educational background of team of inventors influences licensing/translation of the inventions.

25 - Simulation and Optimization of Nurse-to-Patient Assignments

Durai Sundaramoorthi, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu, Jay Rosenberger, Victoria Chen, Prattana Punnakitikashem, Seoung Kim, Deborah Behan, Lance Wheeler

The health care system in the United States has a shortage of nurses. A careful planning of nurse resources is needed to ease the health care system from the burden of the nurse shortage and standardize nurse workload. This research presents simulation and optimization based policies to make nurse-to-patient assignments.

26 - Post Optimization in Mulitple Crew Scheduling Problems

Konrad Borys, Sabre, 3150 Sabre Drive, Southlake, TX, 76092, United States of America, konrad.borys@sabre.com, Shengli Qiu

We present how post optimization can improve a solution quality for crew pairing, rostering, crew recovery and staff rostering problems. We describe different strategies for selecting the subproblem and different methods of solving it. We also show computational results.

27 - Pattern-based Analysis of Supply Chain Collaboration - A Business Process Perspective

Zhe Shan, Penn State University, 419A Business Building, University Park, PA, 16802, United States of America, zheshan@psu.edu

How to analyze the correctness and robustness of business collaboration is essential for supply chain success. Prevailing IT technologies such as Web services lead to considerable automatic inner- or cross-organization interaction. Based on them, we propose a pattern compatibility matrix and rules that allow us to simplify the task of checking compatibility between two or more processes. Via this way we give executives a metric to evaluate the maturity of a business collaboration.

28 - A Stochastic Location Model for Hurricane Relief

Desiree Tejada-Calvo, Florida International University, 10555 West Flagler Street, Miami, FL, 33174, United States of America, dteja001@fiu.edu, Martha Centeno

Unlike earthquakes and terrorist attacks, a hurricane response plan can be activated ahead of time, since a hurricane is predicted at least five days before it makes landfall. In this study, a dynamic stochastic model to locate facilities

during the response phase of a hurricane disaster is presented. The novelty of the model is that it incorporates the strength and path of the hurricane as stochastic processes. These stochastic behaviors are modeled as Discrete Markov Chains.

29 - Process Standardization in Services Outsourcing: From Implementation to Performance Improvement
Bryon Balint, PhD Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Posner 315C, Pittsburgh, PA, 15215, United States of America, bbalint@andrew.cmu.edu

Services firms continue to seek innovations that lower costs or enhance delivery performance. This research includes three related empirical studies which evaluate the use of a process standardization framework in an offshore service delivery center. Study 1 focuses on process implementation, while studies 2 and 3 examine the resulting performance improvements.

30 - Emergency Shelter Location and Resource Allocation
Sara Ghorbani, PhD Student, Rutgers University, ISE Department, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, ghorbani@eden.rutgers.edu

Recent unexpected climatic events are testing our emergency response capabilities. In such an event, people can be moved to shelters with climate controlled environments and provisions for healthcare needs. We present a plan for evacuation with the objective of minimizing the adverse health effects of a weather related disaster. We introduce a stochastic program to solve the emergency-shelter location and allocation problem in which people are assigned to optimally located and equipped centers.

31 - An Approach to Renovation Task Sequencing with Multi-Criteria Objectives
Steven Yuhaski, Jr., Operations Research Analyst, Natick Research, Development, and Engineering Center, 1 Kansas St., Natick, MA, 01760, United States of America, steven.yuhaski@us.army.mil

Large sections at facilities undergoing extensive renovation often require personnel to move temporary shelters having limited capacity, prior proceeding to their final locations. A model of the flow of personnel to various locations, as a function of optimal task sequencing, via an efficient genetic programming heuristic, has been formulated.

32 - Addressing Sources of Uncertainty in Strategic Fire Planning
Matt Thompson, USDA Forest Service, Rocky Mountain Research Station, Missoula, MT, United States of America, matt.thompson@gmail.com, Dave Calkin

Strategic fire planning is subject to manifold sources of uncertainty. Beyond the unpredictability of wildfire behavior, uncertainty stems from inaccurate/missing data, poor scientific understanding of ecological response to fire, and relative prioritization of non-market resource values. This work attempts to systematically align sources of uncertainty with the most appropriate decision-support methodologies, in order to facilitate cost-effective, risk-based wildfire planning efforts.

33 - Credit Risk Portfolio Optimization
Oleksandr Romanko, PhD Candidate, McMaster University, 1280 Main Street West, Hamilton, ON, L8S4K1, Canada, romanko@mcmaster.ca, Tamas Terlaky, Helmut Mausser, Ian Iscoe, Alexandr Kreinin

We develop, evaluate and compare several optimization models that derive from a structural, or Merton-type, model for credit risk. In particular, we consider formulations that combine simulation with analytic approximations, when minimizing Value-at-Risk or expected shortfall of a credit-risky portfolio. Theoretical results and computational tests on large datasets are reported.

34 - Integrated Dispatching Problem in Container Terminals
Yuan Wang, PhD Candidate, National University of Singapore, BLK E1A05-21, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, wangyuan@nus.edu.sg

The objective of our study is to develop a scientific decision tool to systematically assist in managing various major operational processes within a real container terminal, such as quay crane, yard crane, and vehicle transportation activities. The tool is to address the integrated problem for transshipment hub which takes into consideration of the coordination among all the equipments. Simulation and optimization techniques will be deployed to integrate these activities.

35 - Supply Chain Optimization for the World Food Programme
James Wade, Student, Georgia Institute of Technology, 400 17th St. NW #2409, Atlanta, GA, 30363, United States of America, j.wade@gatech.edu, Manuel Jimenez, Lawrence Li, Alvaro Morales, Ozlem Ergun, Santiago Aviles, Elhadj Bah

We will discuss our work with WFP, food aid arm of the United Nations, to improve supply chain performance in ongoing (non-emergency) operations. An inventory-ordering tool was created to help standardize inventory policies and aid in decision-making. The team also built an optimization model of the global supply chain network to investigate the effects of proposed strategic changes such as pre-positioning. Preliminary results have predicted savings and increases in service levels.

Tuesday, 1:30pm - 3:00pm

■ TC01

C-Room 21, Upper Level

Risk in Portfolio Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu

1 - Managing a Portfolio of Risks
Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu, Igor Linkov

We describe several key steps in applying DA to a portfolio of risks. First, we frame the portfolio and map it to a portfolio of decisions. Alternatives include allocation of funds to reduction activities for each risk, but may be more specific, e.g., mitigation, amelioration, diversification, and sharing. Risk interactions such as correlation and causal relationships must be efficiently characterized. Value functions are designed to consider significant losses across multiple dimensions.

2 - Using Portfolio Objectives to Define and Manage Portfolio Risk
Jack Kloeber, Kromite LLC, 12 Penns Trail, Newtown, PA, 18940, United States of America, jkloeber@kromite.com

In R&D organizations, budget, talent, time, constrain the number and size of R&D projects which can be resourced. Organizational objectives drive us to choose which project strategies should be funded. Since R&D is inherently risky, management needs a process for taking portfolio risk, not project risk, into account when making such decisions. We will discuss methods for accomplishing this, as well give examples of lost value when portfolio risk is ignored.

3 - A Simple Mean-risk Model with Behavioral and Prescriptive Flexibility
Alessandra Cillo, Assistant Professor, IESE, Avenida Pearson 21, Barcelona, 08034, Spain, acillo@iese.edu, Philippe Delquie

We propose a behavioral Mean-Risk model that fulfills first and second order stochastic dominance generalizing results on Mean-Gini, and the axioms of Convex Risk Measures. It produces behavior intermediary between Expected Utility and Rank-Dependent Utility. Model's predictions in asset trading and allocation are provided.

4 - Portfolio Optimization of Natural Resources with an Application to the Management of Forest Stands
Janne Kettunen, Assistant Professor, University of Calgary, Haskayne School of Business, Calgary, AB, T2N 1N4, Canada jkettunen@london.edu, Ahti Salo

We develop a stochastic optimization model for a forest owner who needs to determine medium-term harvesting strategies under uncertainty about timber prices. Risks are managed by applying conditional value at risk and satisfying risk measures. The results suggest that extreme risks can be significantly reduced without appreciable reductions in the expected proceeds from timber sales. The results also suggest that risk averse owners tend to harvest their forests earlier than risk neutral owners.

■ TC02

C-Room 22, Upper Level

Bayesian Simulation and Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jason Merrick, Associate Professor, Virginia Commonwealth University, Richmond, VA, 23084, jrmerric@vcu.edu

1 - Bayesian Simulation and Decision Analysis: An Expository Survey
Jason Merrick, Associate Professor, Virginia Commonwealth University, Richmond, VA, 23084, jrmerric@vcu.edu

Research into Bayesian analysis of computer simulations has appeared mostly in the simulation, not decision analysis, literature. The hope is that this expository survey will engender more work in the area by decision analysts. We discuss the main areas of research: input analysis, propagation and estimation of output uncertainty, output analysis, making decisions with simulations, selecting the best simulated system, and applications of Bayesian simulation methods.

2 - A Bayesian Model for Sampling Correlated Inputs
Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu, Canan Gunes

We consider a stochastic simulation with inputs having Normal-To-Anything (NORTA) distribution. Utilizing Sklar's marginal-copula representation together with Cooke's copula-vine specification, we derive a copula-based representation for the NORTA distribution and develop a Bayesian model for the fast sampling of the NORTA parameters. We use the Bayesian model for capturing stochastic uncertainty and multivariate parameter uncertainty in stochastic simulations.

3 - Incorporating Constraints in Bayesian Multiattribute Ranking and Selection
John Butler, Clinical Professor of Finance, University of Texas at Austin, Finance Department, Mail Code B6600, 1 University Station, Austin, TX, 78712, United States of America, John.Butler2@mccombs.utexas.edu

Designers of complex systems are faced with a series of challenging problems. Beyond the inability to precisely specify the relationship between design parameters and system outputs, the inherent uncertainly in the system can lead to variability in the performance estimates for each alternative. In this presentation we combine multiattribute utility theory and Bayesian ranking and selection procedures with a focus on the right way to think about a "constraint" on alternative performance.

4 - Regression with Dirichlet Process Mixtures of Generalized Linear Models
Lauren Hannah, Princeton University, Department of ORFE, Sherrerd Hall, Charlton St., Princeton, NJ, 08540, United States of America, lhannah@Princeton.EDU, David Blei, Warren Powell

High-dimensional, nonparametric regression is a notoriously difficult problem. We present a novel, flexible approach that uses a Dirichlet process prior to mix over both the covariates and response, which is modeled by a GLM. We give conditions for consistency and apply the method to several small problems with continuous and categorical covariates and continuous and count responses.

■ TC03

C-Room 23A, Upper Level

Multiple Objective Optimization: Applications

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Altannar Chinchuluun, Dr., University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, altannar@ufl.edu

1 - The Bicriterion Stochastic Knapsack Problem
Kim Allan Andersen, Professor, Aarhus School of Business, Aarhus University, Fuglesangs Alle 4, Aarhus V, 8210, Denmark, KIA@asb.dk, Lars Relund Nielsen, Daniele Pretolani, Matthias Ehrgott

We have a known capacity of a resource, and a finite set of projects. Each project requires some units of the resource which is not known in advance, but given by a discrete probability distribution with a finite number of outcomes. A selected project gives rise to two rewards, which only depend on the project chosen. The goal is to design a set of resource adaptive strategies for choosing the projects such that the total expected value of the two objective functions is maximized.

2 - From Tradeoffs-based to Tradeoffs-free Economics, MCDM and Optimization
Milan Zeleny, Professor Dr., Fordham University, 113 West 60th Street, New York, NY, 10023, United States of America, mzeleny@fordham.edu

We present new perspectives on Multiple Criteria Decision Making (MCDM) as they manifest themselves in economics, decision making and optimization through the shift from the traditional tradeoffs-based analysis to modern tradeoffs-free design. From optimizing the given we explore designing the optimal, from Pareto-optimal we move to the optimal. Some computational examples via De novo programming are also included.

3 - From Organizational Stratgegy to Optimal Product Roadmap
Ernest Forman, Dr., Department of Decision Science, School of Business, George Washington University, Washington, DC, 20052, United States of America, forman@gwu.edu, George Tome

Deciding on products/services to produce is a challenge that most companies face. Deciding when to produce the products as well is an even more difficult challenge. This talk will illustrate how an 'optimal' product roadmap can be produced based on an organizations strategic plan, hierarchy of objectives, alternative products/services, dependencies, and resource constraints. Two approaches will be illustrated to address the estimation of anticipated benefits over different time periods.

4 - On Two Multiobjective Combinatorial Optimization Problems
Altannar Chinchuluun, Dr., University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, altannar@ufl.edu, Ashwin Arulselvan

In this talk, we focus on two network optimization problems: an extension of the Critical Node Detection and the biobjective Steiner Minimum Tree problem. The problems have applications in several fields including telecommunications, management science and military strategic planning. We propose both exact and approximate solution techniques for solving these problems.

■ TC04

C-Room 23B, Upper Level

Operations Research Methods for Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Wei Jiang, United States of America, jiangwei08@gmail.com

1 - Fast Quantile-based Clustering for Large-scale Problems
Kyu-Hwan Jung, POSTECH, Engineering Building 4 Office 410, Pohang, 790-784, Korea, Republic of, onlyou7@postech.ac.kr, Jaewook Lee

In many quantile-based clustering algorithms a key computational bottleneck is the cluster labeling time of each data point which restricts the scalability of the methods. Here, we propose a general framework of quantile-based clustering using dynamical system and a novel method to speed up labeling time which is superlinear to the size of data. Various benchmark results are provided to show the effectiveness and efficiency of proposed method with application to image segmentation.

2 - Machine Learning for Rare Event Counts
Nuttha Lurponglukana-Strand, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287-5906, United States of America, nuttha@asu.edu, George Runger, Eugene Tuv, Alexander Borisov

Count data occurs in application areas such as traffic, health, Web mining and so forth. For rare events (such as accidents and Web conversions) many zero counts are expected and an appropriate loss function differs from traditional categorical or numerical choices. Machine learning models for zero-inflated Poisson data are considered here to enhance traditional methods.

3 - Support Vector Machine Learning in Energy Forward Markets
Alexander Malyscheff, University of Oklahoma, 202 W. Boyd, Room #124, Norman, United States of America, malyscheff@gmail.com, Theodore Trafalis

Kernel-based learning techniques such as support vector regression (SVR) derive the regression function based on training set data. In energy markets preliminary test set data is available through forward prices, which can be interpreted as averaging constraints on the regression function within specific time limits. In other words an average label for parts of the test set is known beforehand. We present a SVR formulation, which accounts for preliminary available information on the test set.

■ TC05

C-Room 23C, Upper Level

Panel Discussion: The Roles of Quality, Statistics and Reliability (QSR) in Energy-related Research Areas

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Moderator: Haitao Liao, Assistant Professor, Nuclear Engineering Department, Industrial & Information Engineering Department, 211 Pasqua Building, The University of Tennessee, Knoxville, TN, 37996, United States of America, hliao4@utk.edu

1 - The Roles of Quality, Statistics and Reliability (QSR) in Energy-related Research
Panelist: Haitao Liao, Assistant Professor, Nuclear Engineering Department, Industrial & Information Engineering Department, 211 Pasqua Building, The University of Tennessee, Knoxville, TN, 37996, United States of America, hliao4@utk.edu

Securing the current supply of energy while seeking renewable energy is of vital importance to the energy research community and the society. In this panel discussion session, experts conducting research in nuclear power, wind energy and energy systems will share their experiences and visions with the audience and discuss the major and potential roles of quality, statistics and reliability (QSR) in these energy-related research areas.

2 - Reliability Needs for Nuclear Power Life Extensions
Panelist: Wesley Hines, Professor, Nuclear Engineering Department, University of Tennessee, Knoxville, TN, 37996, United States of America, jhines2@utk.edu

The US currently has 104 nuclear power plants that provide 70% of the non-CO2 emitting electricity. With energy demands growing 40-50% in the next 20 years, the utilities and the Nuclear Regulatory Commission are investigating life extensions beyond 60 years. There are concerns that plants which were originally licensed for 30 years would not be safely operating past 60 years. This presentation will describe some risks inherent in "life beyond 60" and discuss some current research activities.

3 - Wind Energy: Performance, Quality, and Reliabilty
Panelist: Andrew Kusiak, Professor, University of Iowa, 2139 Seamans Center, Iowa City, IA, 52242-1527, United States of America, andrew-kusiak@uiowa.edu

A wind turbine includes systems, such as a rotor, gearbox, generator, and power electronics, all belonging to different engineering domains, yet, they are required to seamlessly optimize, e.g., the power produced, power quality, and reliability of various systems. Meeting these often conflicting objectives is a challenge. A novel optimization concept of wind turbines in the presence of conflicting objectives is discussed. Quality and reliability issues are highlighted.

4 - Data-Driven Maintenance of the Electricity Transmission System
Panelist: Sarah Ryan, Professor and Director of Graduate Education, Iowa State University, Dept of Industrial & Manufacturing Syste, 3004 Black Engineering Building, Ames, IA, 50011-2164, United States of America, smryan@iastate.edu

The US transmission system includes approximately 150,000 power transformers and 600,000 circuit breakers along with over 250,000 miles of high voltage lines. Equipment is operating beyond its intended life and is increasingly stressed by load growth and economically motivated transmission. Remote condition monitoring can improve maintenance decisions but is too costly to deploy everywhere. Recent research aims to use the data effectively and determine where best to gather it.

5 - Multiple Objective Models for Power Generation Expansion Planning
Panelist: Abu Masud, Associate Dean, Professor, Wichita State University, 107 Jardine Hall, 1845 N. Fairmount, Wichita, KS, 67260, United States of America, Abu.Masud@wichita.edu

We have developed three related models for power generation expansion planning that incorporate multiple, conflicting objectives. These models have been explained with the help of a case study involving Mexican power generation planning.

■ TC06

C-Room 24A, Upper Level

Advances in Computer Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Roshan Vengazhiyil, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu

1 - Analysis of Computer Experiments with Functional Response
Ying Hung, Assistant Professor, Department of Statistics, Rutgers, the State University of New Jersey, Department of Statistics, 110 Frelinghuysen Road, Picataway, NJ, 08854, United States of America, yhung@stat.rutgers.edu, Roshan Vengazhiyil, Shreyes Melkote

Most existing methods for analyzing computer experiments with single outputs such as kriging cannot be easily extended to functional outputs due to the computational problems caused by high-dimensionality of the response. In this paper, we propose a sequential kriging procedure to overcome the computational problems. The proposed method is illustrated using a computer experiment conducted for optimizing residual stresses in machined products.

2 - Regression-Based Inverse Distance Weighting for Multivariate Interpolation
Lulu Kang, Ph.D. Candidate, School of Industrial and Systems Engineering, Georgia Tech, 350440 Gerogia Tech Station, Atlanta, GA, 30332, United States of America, lulu@gatech.edu, Roshan Vengazhiyil

Inverse distance weighting is a simple method for multivariate interpolation but has poor prediction accuracy. In this article we show that the prediction accuracy can be substantially improved by integrating it with the usual regression methods. This new predictor is quite flexible, computationally efficient, and works well in problems having high dimensions and/or large data sets. We also develop a heuristic method for constructing confidence intervals for prediction.

3 - Sparse Approximation of Gaussian Process Regression
Chiwoo Park, Researcher, Texas A&M University, 241 Zachry Engineering Research Center, Texas A&M University, 3131 TAMU, College Station, TX, 77843-3131, United States of America, chiwoo.park@gmail.com, Yu Ding, Jianhua Huang

We present a computationally efficient method to estimate posterior distributions of the unobserved points given the discrete observations oversampled from an assumed Gaussian random field. The basic idea is to use a few sparsely located points rather than the whole set of the observations. We provide a systematic way to choose the sparse points.

4 - SDACE: Sequential Design and Analysis of Computer Experiments
Ben Haaland, Department of Statistics, UW-Madison, 1300 University Ave., Madison, WI, 53706, United States of America, benhaaland@hotmail.com, Peter Qian

A sequential approach to gathering data and building accurate emulators for expensive computer experiments is proposed. The approach minimizes the number of observations from the computer experiment, allows confidence statements to be made about the emulator's error rate, and has good numerical properties. Issues addressed include data collection, variance estimation, stopping rules, and numerical stability.

■ TC07

C-Room 24B, Upper Level

Advanced Multivariate Data Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qingyu Yang, Research Fellow, University of Michigan,Industrial and Operations Engineering Department, 1815 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, qiyang@umich.edu

1 - Predicting Hind Limb Muscular Activity Using Neuronal Activities in Primary Motor Cotrex
Hang Zhang, Postdoctoral Research Associate, Arizona State University, Tempe, AZ, 85287, United States of America, hzhang12@mainex1.asu.edu, Chaolin Ma, Jiping He

In order to investigate the association between cortical and hind limb muscular activities, and ultimately to resume locomotion functions for paralysis, we build a finite impulse response model to predict hind limb muscular activities using neuronal activities in primary motor cortex when monkeys are conducting standing and squatting tasks.

2 - A Visualization Decision Support Tool for Multivariate SPC Diagnosis Using Marginal CUSUM Glyphs
Shing Chang, Associate Professor, Kansas State University, 2028 Durland Hall, Industrial and Manufacturing Systems Eng, Manhattan, KS, 66506, United States of America, changs@ksu.edu, Shih-Hsiung Chou

Traditional multivariate control charts combine information from various responses to one value e.g. Hotelling's T2 for process monitoring. Current diagnostic practice involves the use of procedures such as decomposition. In this research, we propose a marginal CUSUM glyph to visualize and decompose out-of-control signals over time. The proposed visualization tool, consisting of a two-sided CUSUM and star glyphs, is capable of indicating when and which variables contributing to the cause.

3 - Multi-Level Information Integration for System Performance Prediction
Jian Liu, Assistant Professor, University of Arizona, Department of Systems and Industrial Eng, The University of Arizona, Tucson, AZ, 85704, United States of America, jianliu@sie.arizona.edu, Jing Li

A complex system may consist of many levels of components and subsystems, whose performance are represented by multiple of random variables. We integrate experimental tests and a priori knowledge on those variables at different levels. By incorporating the component/subsystem interdependency information, a more accurate prediction of system performance is provided.

4 - Monitoring of 3-Dimensional Profiles Using Complex PCA
Qingyu Yang, Research Fellow, University of Michigan,Industrial and Operations Engineering Department, 1815 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, qiyang@umich.edu, Judy Jin

Profile monitoring has received increasing attention recently in quality engineering research. Most of exiting methods focus on monitoring of single profile data. In this research, a new method is proposed to monitor high-dimensional profile data in 3D space, in which complex principle component analysis is used to address the cross correlation between the profiles in different dimensions. The proposed method is demonstrated by monitoring process vibration in 3D space for a hot rolling process.

■ TC08

C-Room 24C, Upper Level

Data Mining for Business Support

Sponsor: Data Mining
Sponsored Session

Chair: Errol Caby, AT&T Labs, 180 Park Ave, Room B184, Florham Park, NJ, 08801, United States of America, ecaby@att.com

1 - Mining User-Supplied Data
Errol Caby, AT&T Labs, 180 Park Ave, Room B184, Florham Park, NJ, 08801, United States of America, ecaby@att.com

In this paper, we look at issues involved in mining user-supplied data and describe an approach that was used to extract information from the data. This approach uses third-party data to both regularize the user-supplied data and to help fill in missing data.

2 - A New Model for Behavioral Customer Segmentation
Erick Moreno-Centeno, PhD. Candidate, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, United States of America, erick_moreno@berkeley.edu, Rodolfo Catena, Phillip Yelland, Dorit Hochbaum

This study considers how to process commercial data from SUN Microsystems in order to provide insights on the rate of new product adoption by the company's consumers. We use a novel optimization model for data mining that minimizes the sum of deviations from pairwise comparisons and deviations from priors on the customers' behaviors. We analyze the results with respect to various dimensions of the customer base and report on the generated insights.

3 - NLP and Text Mining: An Application Proposal for Reader Comments in Online Journals
Behlül Çaliskan, Research Assistent, Marmara Universitesi Nisantasi Kampusu, Iletisim Fakultesi, Dr. Celal Oker Sk. No: 14/7 Harbiye, Sisli /Istanbul, Turkey, behlul.caliskan@marmara.edu.tr

Extracting semantic relationships between entities mentioned in text documents is an important task in natural language processing (NLP). The various types of relationships that are discovered can provide useful structured information to a text mining (TM) system. In this presentation, the ways of integrating NLP techniques to solve a TM problem will be examined, some new applications for TM will be looked at and a TM application proposal for reader comments in online journals will be offered.

■ TC09

C-Room 25A, Upper Level

Joint Session APS/MIF: Scheduling in Queueing Systems

Sponsor: Applied Probability & Minority Issues Forum
Sponsored Session

Chair: Nilay Argon, Assistant Professor, University of North Carolina, 333 Hanes Hall, Chapel Hill, NC, 27599, nilay@unc.edu

1 - Optimal Control of a Two-Class Call Center with Abandonments
Mark Lewis, Associate Professor, Cornell University, 226 Rhodes Hall, Ithaca, NY, 14853, United States of America, mel47@cornell.edu, Douglas Down, Ger Koole

We consider a two-class call center with abandonments. In the first model, holding costs and abandonment penalties are considered. In the second model, rewards for service completion are considered. In each case, we discuss dynamic, optimal control.

2 - Managing Queues with Heterogeneous Servers
Rhonda Righter, IEOR Department, UC Berekely, Berkeley, 94720, United States of America, Rrighter@ieor.berkeley.edu, Jung Hyun Kim, Hyun-soo Ahn

We consider several versions of the job assignment problem with servers of different speeds. When there are two classes of customers, primary and secondary, we develop an intuitive proof that the optimal policy that minimizes mean waiting time. We also apply our key argument to the classical slow-server problem, and obtain more general results for the two-server case and strengthen existing results for more than two servers.

3 - Scheduling Impatient Jobs in a Clearing System with Multiple Servers
Evin Uzun, UNC-Chapel Hill, 800 Pritchard Ave Ext H2, Chapel Hill, NC, 27516, United States of America, evin@email.unc.edu, Nilay Argon, Serhan Ziya

We consider a clearing system with multiple servers and a fixed number of jobs that are impatient. Jobs can be classified based on their lifetime, service time, and reward distributions. The objective is to maximize the expected total rewards earned. We find conditions under which the optimal dynamic policy may depend on the state, and under which it does not. Based on these characterizations, we develop easy-to-implement heuristic policies and test their performances by numerical experiments.

■ TC10

C-Room 25B, Upper Level

Joint Session QSR/ HAS: Defining the Science of Quality in Health Care

Sponsor: Quality, Statistics and Reliability & Health Applications
Sponsored Session

Chair: John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

1 - Service Science: Going Beyond I Know it When I See It
Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

Science has a structure composed of theory, theorems, methodologies and ontologies unique to each discipline. Absent a theoretical context all available information will seem equally relevant. What are the challenges in defining the science of health care quality?

2 - Operational Challenges in Measuring Quality in a School of Medicine: Perspective of a Dean
David Brenner, Vice Chancelleor, UCSD School of Medicine, 9500 Gilman Drive, La Jolla, CA, United States of America, dbrenner@ucsd.edu

Schools of medicine are a complex confederation of competing interests. Measuring the Quality of the total enterprise is ill defined but must encompass measures of quality in teaching, research, community responsiveness as well as management of fluctuating budgets, political expectations and, ultimately, identifying future directions and priorities.

3 - Life at 40,000 Feet Facing Anti-aircraft Fire: Perspective of a Hospital CEO
Richard Liekweg, CEO, UC San Diego Medical Center, 200 West Arbor Drive, San Diego, CA, 92103-8970, United States of America, rliekweg@UCSD.EDU

Numerous studies examine methods to improve hospital function ranging from inventory control and operating room scheduling through predicting emergency room demand and discrete event simulation of patient throughput. All fail to capture the realities confronting Hospital Management. This paper will discuss a CEO's perspective of the regulatory, organizational, community and staffing challenges of a modern hospital system

4 - Your Money's Worth: Research Questions in Quality Health Care Service
Cerry Klein, National Science Foundation, National Science Foundation, Wahington D.C., United States of America, cklein@nsf.gov

NSF funds basic research in Systems Enterprise Engineering. Most applications address basic methodologies. All too frequently the proposed methodological investigations are independent of actual challenges in measuring or improving quality in health care and/or lack a theoretical orientation that would explore what health care quality research might be. This presentation will discuss the value of grounding methodology in the science of health care quality.

■ TC11

C-Room 25C, Upper Level

Control and Design of Queueing Systems

Cluster: Queueing Models
Invited Session

Chair: Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@unc.edu

1 - Herding in Two Queues
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We model customer herd behavior in two parallel queues when they observe queue lengths. The effect of congestion on her behavior is significant. In low traffic, herd behavior is pronounced. Herd behavior is dependent on the total queue length in the market, in addition to the relative queue lengths in the market.

2 - Staffing and Routing of Queueing Systems in the ED+QED Regime
Mor Armony, New York University, 44 West 4th Street #8-62, New York, NY, 10012, marmony@stern.nyu.edu, Avishai Mandelbaum

In large-scale service systems such as call centers the manager needs to determine staffing levels and routing rules. We formulate the problem of determining staffing and routing so as to minimize staffing cost subject to commonly used service level constraints on the tail of the waiting time distribution. We solve this problem asymptotically and show that the resulting ED+QED operating regime is significantly simpler than the commonly studied QED regime.

3 - Strategies for a Single Product Multi-Class M/G/1 Make-to-Stock Queue Serving Different Markets
Hossein Abouee Mehrizi, Rotman School of Management, 105 St. George Street, Toronto, Canada, H.AboueeMehrizi07@Rotman.Utoronto.Ca, Baris Balcioglu, Opher Baron

For an M/G/1 make-to-stock queue with prioritized customers and an identical product, we analyze the strict-priority and rationing policies when the inventory is centralized. We present an efficient algorithm to get the optimal rationing levels. For the case with decentralized inventory, we present the exact analysis of dispatching policy. We show that this policy is optimal in a make-to-order system.

4 - On The Relationships Among Traffic Load, Capacity, and Throughput for Finite Capacity Queues
Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@unc.edu

With some exceptions, throughputs of finite capacity queues typically increase with additional capacity. We investigate how this improvement depends on the traffic load. Specifically, for the M/G/c/c queue, we show that throughput improvement that would be obtained by adding an extra server is increasing in traffic load. For the M/M/1/m and M/G/1/m-PS queues, we show that throughput improvement that would be obtained by adding an extra buffer space is unimodal in traffic load.

■ TC12

C-Room 26A, Upper Level

Integer Programming and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Branching on Hyperplanes for Mixed Integer Programs
Bala Krishnamoorthy, Washington State University, Pullman, WA, United States of America, kbala@wsu.edu, Keith Clawson, Ye Tian

We consider strategies for branching on hyperplanes, rather than branching on variables, for MIPs. The hyperplanes are identified by basis reduction calculations. Previously, such techniques have proven effective for knapsack problems and marketshare IPs. We extend these techniques to MIPs, and apply them to various problems from the MIPLIB. We discuss cases where they proved effective, and ones for which they made the solution process harder than when using normal branching.

2 - Basis Reduction and the Complexity of Branch-and-Bound
Mustafa Kemal Tural, Dept of Statistics and Operations Research, UNC Chapel Hill, Hanes Hall, Chapel Hill, NC, 27599, United States of America, tural@email.unc.edu, Gabor Pataki

Branch and bound (BB) is a classical method to solve integer programming problems. In this work, we show that BB is efficient, if we apply a simple transformation in advance to the constraint matrix of the problem. We prove that if the coefficients are drawn from 1,...,M for a sufficiently large M, then for almost all such instances number of nodes enumerated by BB is at most 1. We give some numerical values of M which make sure that 99 percent of the reformulated problems solve at the rootnode.

3 - Structural Search and Optimization in Social Networks
Milind Dawande, Professor, University of Texas at Dallas, 800 West Campbell Rd. SM30, School of Management, Richardson, TX, 75080, United States of America, milind@utdallas.edu, Yunxia Zhu, Vijay Mookerjee, Chelliah Sriskandarajah

The explosive growth in the variety and size of social networks has focused attention on searching them for fundamental set-based structures. We discuss algorithmic results for two search problems based on the notions of influential and central sets in the network that highlight, respectively, the specific role and specific location of a set.

4 - A New Heuristic for General Mixed Integer Programming
Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, Kuo-Ling Huang

We present a new heuristic for rounding a continuous solution to a mixed integer solution in integer programming. The heuristic is based combining three ideas: (i) successively enlarging a simple ellipsoid, finding integer solutions in this ellipsoid, without letting a solution escape; (ii) performing a random walk in the continuous relaxation; (iii) using a feasibility pump. Numerical results will be presented.

■ TC13

C-Room 26B, Upper Level

Computational Optimization for Logistics Applications

Sponsor: Computing Society
Sponsored Session

Chair: David Woodruff, Professor, University of California Davis, UC Davis, Davis, CA 95616, Davis, CA, United States of America, dlwoodruff@ucdavis.edu

1 - Adaptive Granular Local Search for a Dynamic Vehicle Routing Problem
Arne Lokketangen, Professor, Molde University College, Postboks 2110, Molde, N-6402, Norway, Arne.Lokketangen@HiMolde.no, Vinicius Armentano, Rodrigo Branchini

City distribution often entails dynamic updating of customer requests. We describe the use of granular local search for such a problem, where the granularity depends on the available search time. We assess our system on test problems based on real-life Brazilian transportation companies.

2 - Maritime Distribution of Stone Products
Johan Oppen, Associate Professor, Molde University College, Postboks 2110, Molde, N-6402, Norway, Johan.Oppen@himolde.no

The Norwegian company NorStone has a yearly production of 8 mill. tons of stone products. The products are mainly transported by sea, and varying demand throughout the year together with limited inventory capacities make the task of distribution planning quite challenging. We present a problem description and a mathematical model for this inventory and distribution problem. Possible solution methods are also discussed.

3 - Implementation of a Decomposition Method in Solving Biofuel Supply Chain Problems under Uncertainty
Yueyue Fan, Associate Professor, UC Davis, Department of Civil Engineering, One Shields Avenue, Davis, CA, 95616, United States of America, yyfan@ucdavis.edu, Chien-Wei Chen

A two-stage stochastic programming model is formulated to optimize the entire supply chain system for bioethanol production from biowastes to hedge against fuel demand uncertainties. A decomposition method based on Lagrange relaxation, progressive hedging method, is sought to overcome the computational challenges involved in this large-scale mixed integer problem.

4 - A RAMP Approach to the Resource Constrained Project Scheduling Problem
Chris Riley, University of Mississippi, School of Business Administration, Oxford, MS, 38677, United States of America, criley@bus.olemiss.edu, Cesar Rego, Haitao Li

A Relaxation Adaptive Memory Programming (RAMP) algorithm is developed to solve large-scale resource constrained project scheduling problems (RCPSP). The RAMP algorithm presented here takes advantage of a cross-parametric relaxation and extends a recent approach that casts the relaxed problem as a minimum cut problem. Computational results will be presented and discussed.

■ TC14

C-Room 27A, Upper Level

Optimization in Practice V - Modeling

Sponsor: Computing Society
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

Co-Chair: Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

1 - Smoothing the Transition to Optimal Solutions
Ed Klotz, CPLEX Product Expert, ILOG, an IBM Company, 889 Alder Avenue, Suite 301, Incline Village, NV, 89451, United States of America, klotz@us.ibm.com

Optimal solutions to Mixed Integer Programs are very useful when configuring a new physical system. However, they may impose too many changes to easily implement when modeling currently operational systems. In such models, a sequence of feasible solutions that improve the objective while incrementally changing the current operations can smooth the transition process. We will discuss recent advances in the ILOG CPLEX Optimizer that facilitate the generation of such a sequence of solutions.

2 - GAMS – Features You Might Not Know About
Alex Meeraus, President, GAMS Development Corporation, 1217 Potomac Street NW, Washington, DC, 20007, ameeraus@gams.com

In the last decade the General Algebraic Modeling System (GAMS) has been improved in various ways. Some of the improvements are visible and known to most of the users like the availability of new solvers or changes you can see in the integrated development environment. Others are more hidden and the user might not know that these exist like the Macro Facility and the Matching Operator. In this talk we give an overview of features which were added in the recent and not so recent past.

3 - Recent News and Trends in Optimization and Modeling
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

In this presentation, we will cover several major news and noteworthy trends in optimization that occurred during the past year, including: current state-of-the-art in optimization and modeling. The new MPL FREE Development and Academic Programs. New solvers from GUROBI and Microsoft. Purchase of ILOG and DASH by IBM and Fair Isaac. Emergence of grids, clouds and virtual machines and their impact on the field of optimization.

■ TC15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Frontline Systems, Inc. - Risk Analysis and Robust Optimal Solutions: High Productivity Modeling in Excel
Daniel Fylstra, President, Frontline Systems Inc., 913 Tahoe Blvd., #7, Incline Village, NV, 89450, United States of America, dfylstra@frontsys.com

The path to better decisions can be shorter: More than ever, models for risk analysis and optimal resource allocation in the presence of uncertainty can be built more easily, scaled up to large size, and solved more effectively in Microsoft Excel. Robust optimization and stochastic programming models that once required scarce expertise and long development cycles are easy to create and solve in Excel. Software that exploits multi-core PCs in both optimization and simulation yields faster-than-ever solutions. This session focuses on how practitioners can build models, get results quickly, and create reports, charts and graphs to communicate results to decision-makers.

2 - SAS - Building and Solving Optimization Models with OPTMODEL
Ed Hughes, Product Manager, SAS/OR, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27513, United States of America, Ed.Hughes@sas.com, Trevor Kearney

We'll demonstrate the use of OPTMODEL's powerful algebraic modeling language to build and solve a range of models including LP, MILP, QP, and general NLP. We'll also illustrate how OPTMODEL can employ both standard and customized algorithms to tackle more challenging optimization problems, integrating easily with SAS data handling, analytic, and reporting capabilities as needed.

■ TC16

C-Room 28A, Upper Level

Joint Session IS/eBusiness: Internet Search and Advertising Auctions

Sponsor: Information Systems & eBusiness
Sponsored Session

Chair: De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E, Lexington, KY, 40506, United States of America, de.liu@uky.edu

1 - Clicktracks: Understanding Consumers' Online Search and Information Retrieval
Vandana Ramachandran, Assistant Professor, University of Utah, Department of Operations and Info. Sys., 1645 East Campus Center Drive, Salt Lake City, UT, 84112-9301, vandana@business.utah.edu

We study consumers' online search and information-seeking patterns in an online retail context for durable goods. Using clickstream data, we determine the optimal configuration of promotional information and messages that should be provided by sellers to help improve online purchase-related outcomes. Our findings provide several implications for sellers to devise targeted and customized information-provision at appropriate stages in consumers' shopping cycles.

2 - User-Generated Content in Mobile Digital Media
Sang Pil Han, Post-Doctoral Researcher, NYU Stern, 44 West 4th Street, New York, United States of America, shan2@stern.nyu.edu, Anindya Ghose

Consumer adoption and usage of mobile communication and multimedia content services has been growing steadily over the past few years in many countries around the world. We develop and estimate a structural model of user behavior and learning with regard to content generation and usage activities in mobile digital media environments.

3 - A Theory of Payment Schemes
De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E, Lexington, KY, 40506, United States of America, de.liu@uky.edu, Siva Viswanathan

A variety of different payment schemes are adopted in Internet advertising, including pay-per-impression, pay-per-click, and pay-per-sales. We study the payment scheme choice in a setting where the ex-post value of advertising slots is determined by both the characteristics of the publisher and that of the advertiser. The publisher trades off between signaling his quality to advertisers and selecting the best advertisers.

■ TC17

C-Room 28B, Upper Level

The Impact of Social Networks, Contributor Incentives, and Proprietary Competitors on Open Source Development

Sponsor: e-Business
Sponsored Session

Chair: Terrence August, Assistant Professor, UCSD, Rady School of Management, 9500 Gilman Drive, MC 0553, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu

1 - Social Networks and Software Designs in Open Source and Closed Source Projects
Sandra Slaughter, Professor of Information Technology Management and Alton M. Costley Chair, Georgia Tech College of Management, 800 W. Peachtree St. NW, Atlanta, GA, 30308, United States of America, sandra.slaughter@mgt.gatech.edu, Chiara Francalanci, Francesco Merlo

This study proposes a symmetry between the social network structure of developers and the software designs they create. Analysis of longitudinal archival data collected on open source and closed source projects provides support for this hypothesis. However, the findings also reveal significant differences between the Open Source and Closed Source projects.

2 - Network Effects: The Influence of Structural Social Capital on Open Source Project Success

Yong Tan, Associate Professor of Information Systems, University of Washington, Foster School of Business, ytan@u.washington.edu, Param Singh, Vijay Mookerjee

This paper investigates the impact of network social capital - the benefits open source developers secure from their memberships in a developer collaboration network - on open source project success. Specific hypotheses are tested on a longitudinal panel of 2378 projects hosted at Sourceforge. We find that projects with greater internal cohesion, moderate external cohesion, moderate technological diversity, or greater number of direct and indirect external contacts are more successful.

3 - Commercializing Open Source Software: An Examination of Open Source Support Model

Byung Cho Kim, Assistant Professor, Virginia Tech, Business Information Technology, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu, Pei-yu Chen, Tridas Mukhopadhyay

We examine the issue of commercializing open source software (OSS). We investigate whether OSS support model is viable under competition with proprietary software. Our model considers the motivations for and the barriers to OSS adoption. We study the impact of a giant proprietary software vendor's participation in the OSS support market on the viability of OSS support model.

4 - Licensing Decisions and Competition for Integration and Services in Open Source Software

Terrence August, Assistant Professor, UCSD, Rady School of Management, 9500 Gilman Drive, MC 0553, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu, Tunay Tunca, Hyo duk Shin

In this paper, we explore firms' economic incentives to foster open source software initiatives in lieu of proprietary ones and the role of services in software development and value generation. We present an economic model that jointly analyzes software originators and subsequent contributors' investments in software development as well as pricing of software and services under competition.

■ TC18

C-Room 28C, Upper Level

Network Management and Design

Sponsor: Telecommunications
Sponsored Session

Chair: Jun Shu, Penn State University, 462 Business Bldg., University Park, PA, United States of America, junshu@psu.edu

1 - A Decision Model for Optimizing the Network Security Level for Organizations

Soumyo Moitra, Senior MTS, CERT/SEI, Carnegie Mellon, 4500 Forbes Ave, Pittsburgh, PA, 15213, United States of America, sdmoitra@hotmail.com

This paper presents a model to help managers decide on the most appropriate level of network security for their networked information systems. The model considers the costs of security as its level varies and the reduction in expected damages as a result of having that level of security. Various scenarios are constructed from publicly available data and the examples show how the optimal level of network security varies with different conditions.

2 - Information and Communications Technology Supply Chain Integrity

Jun Shu, Penn State University, 462 Business Bldg., University Park, PA, United States of America, junshu@psu.edu, Patrick McDaniel, Karl Rauscher, Thomas La Porta

Modern society is vitally dependent upon reliable and secure information and communications technology (ICT) infrastructure. Most ICT is developed through supply chains that are complex, and outsource to offshore workforces in less developed regions. The integrity of such supply chains and therefore development processes, is very difficult to observe, monitor and ensure. Our research aims to provide a structure and methods for measuring the integrity of ICT supply chains.

3 - Fuel Cells in Telecommunications Applications

Scott Grasman, Missouri S&T, Rolla, MO, 65409, United States of America, grasmans@mst.edu

This presentation addresses the potentially significant role and use of fuel cells in telecommunications. Technology status and growth, early market development, consumer behavior and attitudes, impact of infrastructure availability, and transitional dynamics of fuel cell technologies, infrastructure, and applications are analyzed, including the most significant obstacles, how these obstacles have been approached, and how this information can be used to encourage the use of fuel cells.

■ TC19

C-Room 28D, Upper Level

Joint Session TSL/OR-Societal Impact: Dynamic Evacuation Planning and Operations Models I

Sponsor: Transportation Science and Logistics & OR/MS with Societal/ Humanitarian Impact
Sponsored Session

Chair: Natalia Ruiz Juri, University of Texas at Austin, 6.204 ECJ Hall, 1 University Station C1761, Austin, United States of America, natiruizjuri@gmail.com

1 - Behavior-based Framework for Mass Evacuation

Yu Ting Hsu, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, IN, 47906, United States of America, yhsu@purdue.edu, Srinivas Peeta

We propose a behavior-based operational framework for mass evacuation that factors data availability. An aggregate model is developed to predict zonal behavior (evacuation participation and route choice) in terms of inter-zonal flows in response to information and observable dynamics. In addition, a disaggregate model is proposed to represent individual behavior and incorporated into the framework. Issues are identified and solution directions are discussed.

2 - Optimal Control Strategies for Massive Vehicular Pedestrian Mixed Flows in the Evacuation Zone

Xin Zhang, University of Maryland, 11324 Evans Trail, Apt 201, Beltsville, MD, 20705, United States of America, zhangxin@umd.edu, Gang-Len Chang

This paper presents an integrated model for design of signal plans for massive mixed pedestrian-vehicle flows within the evacuation zone. The proposed model with its embedded formulations for pedestrians and vehicles in the same network can effectively take into their potential conflicts during the evacuation, and generate the optimal routing strategies for guiding evacuees moving toward either the pick-up locations or their parking areas.

3 - A Multi-agent Simulation Incorporating Traffic Behavior for Hurricane Evacuation

Bo Zhang, Rensselaer Polytechnic Institute, CII 5015, 110 8th St., Troy, NY, 12180, United States of America, zhangb5@rpi.edu, W.K. Victor Chan, Satish Ukkusuri

This work presents a multi-agent simulation model for hurricane evacuation based on behavior-oriented agents. The action rules of diverse groups of agents are extensive survey data. We develop the traffic behavior and their interactions during the evacuation process using the set of action rules. We simulate the multi-agent model and obtain insights related to traffic behavior during hurricane evacuations.

4 - Accounting for Information Collection and Utilization in the Routing of Emergency Response Vehicles

Natalia Ruiz Juri, University of Texas at Austin, 6.204 ECJ Hall, 1 University Station C1761, Austin, TX, United States of America, natiruizjuri@gmail.com, Travis Waller

We introduce novel routing strategies which account for the capability of emergency vehicles and other assets to retrieve information about the experienced system state as they traverse it. The proposed models simultaneously address the collection and utilization of real-time information in routing problems on stochastic networks. Exact and heuristic methodologies are implemented to the solution of various numerical examples which demonstrate the potential benefits of the new strategies.

■ TC20

C-Room 28E, Upper Level

Joint Session TSL/OR-Societal Impact: Dynamic Evacuation Planning and Operations Models II

Sponsor: Transportation Science and Logistics & OR/MS with Societal/ Humanitarian Impact
Sponsored Session

Chair: Sirui Liu, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, lius77@vt.edu

1 - A Bi-level Optimization Model to Determine a Control Area for Emergency Evacuation Operations

Yue Liu, Research Assistant, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States of America, troybest@umd.edu, Jie Yu, Gang-Len Chang

This paper presents a bi-level model for use in generating a control area for evacuation operations. The high-level optimization aims to maximize the throughput during the specified evacuation duration, while the low-level intends to minimize the control area size to save limited manpower and resources if the specified duration is sufficient for evacuating all demands. Evaluation results from numerical studies in the Baltimore Region network have demonstrated the model's promising properties.

2 - Formulation and Solution Method for Optimal Gas Refueling Station Locations for Hurricane Evacuation

Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Shuo Wang, Yang Gao, Simge Kucukyavuz

We formulate the optimal gas refueling station location problem as an stochastic mixed integer program in a optimization-simulation framework. The solution procedure is integrated with the DTA model DynusT in that DynusT evaluates the intermediate solution and provides feedback with optimization model. The model was tested on a case study of IH-45 corridor between Houston and Dallas, USA.

3 - Optimization and Simulation Based Model to Select Facility Relocation Sites for No-notice Evacuation

Sirui Liu, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, lius77@vt.edu, Pam Murray-Tuite

We introduce an optimization model to determine optimal relocation sites for facilities with a large amount of dependents to be picked up under no-notice evacuation. A procedure involving iterative runs between this optimization model and the simulation model is developed and a case study in Chicago Heights is tested.

■ TC21

C-Room 30B, Upper Level

Warehouse Operations II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - State Dependent Queueing Models of Material Handling Systems

James MacGregor Smith, Professor, University of Massachusetts, 160 Govenors Drive, Amherst, MA, 01003, United States of America, jmsmith@ecs.umass.edu

Analytical models of material handling systems (MHS) which provide accurate, fast and efficient methods are desireable. Most models of MHS are simulation models. Using state dependent queues, we develop closed queueing network (CQN) models capable of providing a topological network design (TND) tool for these MHS. Numerous computational experiments are included to round out the presentation.

2 - Performance Evaluation of Zone Picking Systems

Ivo Adan, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, iadan@win.tue.nl

Zone picking systems employ a picking concept where the operators are going to the goods, and each operator is responsible for the goods stored in a certain area or zone. A zone picking system can be modeled as a multi-class closed queueing network with finite buffers and so-called jump-over-blocking. We show that important performance such as throughput and utilization of operators can be efficiently and accurately evaluated by employing aggregation and decomposition techniques.

3 - Vehicle Interference Effects in Autonomous Vehicles Based Warehousing Using Systems

Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu, Charles Malmborg, Sunderesh Heragu, Debjit Roy

Warehouses that use autonomous vehicles for storage and retrieval operations within multi-tier racking systems rely on vehicles to provide horizontal the movement within a tier and use lifts to provide vertical movement between tiers. In this research, vehicle interference effects on throughput and cycle times are studied using queuing models. The models are validated using detailed simulations.

■ TC22

C-Room 30C, Upper Level

Risk Management in Supply Chains II

Contributed Session

Chair: Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

1 - On Optimal Continuous Replenishment Rates for Stochastic Inventory Systems under Lost-sales Rules

Junmin Shi, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States of America, jshi@pegasus.rutgers.edu, Benjamin Melamed, Michael Katehakis

Consider a one-product inventory system with a constant replenishment rate under Poisson demands and lost sales. The system incurs a carrying cost and lost-sale penalty. We derive an explicit expression for the time average cost. For exponentially distributed demands, we obtain the optimal replenishment rate. Further, we give numerical computations for other demand distributions.

2 - Optimal Policy Structure for Discrete State/Action Inventory Model with Random Yield

Chelsea White, H. Milton & Carolyn J. Stewart School Chair, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, cwhite@isye.gatech.edu, Tae Su Cheong, Alan Erera

We consider a discrete state/action infinite horizon, expected total discounted cost MDP model of a single product, periodic review inventory problem with lost-sales, deterministic demand, and random yield. We present conditions that guarantee the existence of an optimal policy d^* such that $d^*(z)=0$ for $z<=0$, and for $z>0$, $d^*(z)>=z$ and $d^*(z)-z$ is non-decreasing, and hence has a staircase structure in z, where z is unsatisfied demand.

3 - Applying Autopilot to Improve Scalability and Responsiveness in Supply Chain Network

Junfang Yu, Assistant Professor, Southern Methodist University, Dept of EMIS, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, yuj@lyle.smu.edu, Timothy Tsai, Jerrell Stracener

Scalability and responsiveness are two key elements to mitigate supply risk in a large, complex, and multi-tier supply chain network. Autopilot is an efficient control system designed for managing supply risk in near real-time. It uses real-time operation management collaboration to monitor, notify, and solve supply disruption or quality issue which could be engineering or business related. This presentation addresses the concepts, mechanism, design and implementation of such a system.

4 - Risk Assessment for the Security of Inbound Containers at U.S. Ports: A FMEA Approach

Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

A design of a decision support framework is proposed for a reliable cargo container shipment and handling system based on FMEA. The proposed prototype of a simple risk assessment system is offered that safeguards against potential security risks in cargo container shipments entering U.S. ports.

■ TC23

C-Room 30D, Upper Level

Modeling Human-Social-Cultural Terrain in the Operational Environment

Sponsor: Military Applications Society
Sponsored Session

Chair: Niki Goerger, ERDC LNO to ASA(ALT), US Army Engineer Research and Development Center, 7701 Telegraph Road, Kingman Bldg, Alexandria, VA, 22315, United States of America, niki.c.goerger@us.army.mil

1 - Recognizing Patterns of Anomie that Set the Conditions for Insurgency

Curtis Blais, Naval Postgraduate School, ME Building RM 269, 700 Dyer Road, Monterey, CA, 93943, United States of America, clblais@nps.edu, Robert Shearer, Karen Guttieri, Leroy (Jack) Jackson

A proactive approach to the insurgency problem requires analysis to begin before violence starts. This project proposes to identify patterns of anomie, the loss of compelling norms enabling populations to meaningfully interpret social change that helps facilitate insurgencies; categorize events that trigger their start, and simulate a nation state moving from peace to political violence. This presentation will provide a project overview along with progress to date and planned future efforts.

2 - Relationships and Influence in Cultural Geography Modeling

Leroy (Jack) Jackson, Senior Analyst & Deputy Director, US Army TRADOC Aalysis Center, P.O. Box 8695, Monterey, CA, 93933, United States of America, lajackso@nps.edu

This presentation will describe how relationships and influence are modeled in a cultural geography model of civilian populations in stability operations. The purpose of the model is to understand the response of the population to insurgent, government and stability force. This presentation will focus on relationship and influence modeling with social network theory and other social theories related to influence using persuasion, negotiation and coercion.

3 - Population and Infrastructure: Decision-Making in Theater

Timothy Perkins, US Army Corps of Engineers - ERDC-Champaign, ATTN: ATRC-RDM, P.O. Box 8692, Monterey, CA, 94943, United States of America, Timothy.K.Perkins@us.army.mil, Jeffrey Burkhalter

Decision-makers have limited ability to explore socio-cultural impacts of infrastructure projects on local populations. Work is underway to develop an exploratory analytical ability to simulate a variety of infrastructure projects in the Cultural Geography model to provide a prototypical method and implementation of data collection, analysis and representation facilitating a culturally-based analysis of infrastructure options in a Battalion area of operations.

4 - US Army Geospatial Center Support to the OSD Human Social Culture Behavior Modeling Program

Joseph Watts, Special Projects Officer, US Army Geospatial Center, 7001 Telegraph Road, Alexandria, VA, 22315, United States of America, Joseph.M.Watts@usace.army.mil, Dylan Schmorrow

The US Army Geospatial Center (AGC) is charged with oversight of the Army Geospatial Enterprise. A fundamental element of the AGC portfolio is the OSD Human Social Culture Behavior (HSCB) Modeling Program which is a five year R&D effort to develop a science base and associated technologies for modeling human, social and cultural behavior. AGC contributes program management, test and assessment, transition planning, geospatial modeling, and knowledge management engineering support.

■ TC25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Optimization in Flight Scheduling

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Binod Maharjan, Texas Tech University, Box # 43061, Lubbock, TX, United States of America, b.maharjan@ttu.edu

1 - Set-partitioning Model for Dynamic Adjustment to Air Traffic Control Sectors

Peng Cheng, Tsinghua University, Main Buidling 411, Beijing, China, chengp@tsinghua.edu.cn, Rui Geng

A set-partitioning model for dynamically adjusting air traffic control sectors is built to balance controllers' workload and to increase airspace capacity. The optimal number and specific forms of open sectors are given from the optimization model. A method to evaluate controllers' workload based on statistical analysis of historical radar data is proposed and applied to the set-partitioning model. Examples show that the model can get quick solutions to optimal sector configuration problems.

2 - Linear Network Structured Airline Periodic Aircraft Scheduling

Gerardo De la O, Texas Tech University, Box 43061, Lubbock, TX, 79409, United States of America, gerardo.o@ttu.edu, Yuanlin Zhang, Timothy Matis

For a linear network structured airline it is essential to regulate the spacing of consecutive flights that serve the same origin-destination city-pair and to find the optimal operational cost. In this study, we assume to know the number of aircrafts characterized by a unique identification number and their routes and we want to find, with numerical approaches, their paths which consider flight departure times that minimize the novel departure spill opportunity cost and on-land operational cost.

3 - A Hybrid Approach to Airline Crew Pairing Optimization

Jose L. Walteros, Departamento de Ingenieria Industrial, Universidad de los Andes, Carrera 1 Este # 19 A - 40, Bogota, Colombia, j-walter@uniandes.edu.co, Miguel A. Vargas, Diana Florez, Andrés L. Medaglia

This work proposes a solution approach for the single and multiday crew pairing problem considering layovers and deadheads. The strategy is comprised of: 1) a binary programming model; 2) a set partitioning (SP) model; 3) a set covering (SC) model; and 4) a split-based heuristic that follows the principle of route-first cluster-second. The SP and SC models are solved under a column generation scheme. The four models are compared using test instances from a real mid-sized airline.

4 - Flight Gate Reassignment Optimization Algorithm for Hub-spoke Airport

Binod Maharjan, Texas Tech University, 2500 Broadway, Lubbock, TX, binodm@gmail.com, Timothy Matis

The real time reassignment of gates due to flight delays at hub airports is a difficult task, and is generally done ad-hoc by gate managers. Our research develops a decision support tool with an embedded non-linear binary optimization routine that proactively reassigns gates to min fuel burn and overall passenger disruption on a fixed time interval while controlling the level of propagated reassignments. Specifically, gate mangers may use this tool to balance the tradeoff between optimal gate reassignment and minimization of gate assignment schedule disruption. We show that this tool is both computationally efficient and practically useful though several test cases.

■ TC26

C-Room 31B, Upper Level

Edelman Finalists Reprise - III

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

1 - Edelman Finalist: Operations Research Improves Sales Force Productivity at IBM

Richard Lawrence, IBM, 1195 West Fremont Avenue, Sunnyvale, CA 94087, United States of America ricklawr@us.ibm.com, Claudia Perlich

In 2009 IBM was recognized as a finalist of the INFORMS Edelman competition for its analytical initiatives to improve the productivity of its global salesforce. OnTARGET provides a set of predictive models designed to identify new sales opportunities and is available to over 13,000 sales reps. The Market Alignment Program allocate sales resources based on validated analytical estimates of revenue opportunity. The business impact is estimated to be in the hundreds of millions of dollars.

2 - CSX Uses OR to Cash in on Optimized Equipment Distribution

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu, Dharma Acharya, David Sellers

CSX implemented the U.S. rail industry's first real-time, fully integrated equipment distribution optimization system, the Dynamic Car Planning system (DCP). DCP allows the OR modeling to be seamlessly integrated into the process of assigning empty cars to customer car orders. CSX estimates it has saved $561 million and avoided $1.4 billion in capital expenditure. The public has benefited by an estimated $600 million from improved highway safety, congestion, and pollution.

■ TC27

C-Room 31C, Upper Level

Agent-based Modeling and Simulation: Overview and Mini-tutorial

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Charles Macal, Director, Center for Complex Adaptive Systems, Argonne National Laboratory, 9700 S. Cass Avenue, Decision & Information Sciences-Bldg 900, Argonne, IL, 60439, United States of America, macal@anl.gov

1 - Agent-based Modeling and Simulation: Overview and Mini-tutorial

Charles Macal, Director, Center for Complex Adaptive Systems, Argonne National Laboratory, 9700 S. Cass Avenue, Decision & Information Sciences-Bldg 900, Argonne, IL, 60439, United States of America, macal@anl.gov, North Michael

Agent-based modeling and simulation (ABMS) is a new approach to modeling systems comprised of autonomous, interacting agents. Complex adaptive systems, emergent behavior, and self-organization are a few of the notions from ABMS. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects, and the relationship of ABMS to conventional OR.

2 - Tutorial and Overview of Agent-based Modeling and Simulation and Complex Adaptive Systems

North Michael, Deputy Director, Complex Adaptive Systems Center, Argonne National Laboratory, 9700 S. Cass Avenue, Decision & Information Sciences Division, Argonne, IL, 60439, United States of America, north@anl.gov

Agent-based modeling and simulation (ABMS) is a novel approach to modeling systems comprised of interacting agents based on the complex adaptive systems (CAS) paradigm. ABMS is finding widespread application in many areas. This tutorial and overview presents the foundations of CAS and ABMS, approaches for developing agent models from spreadsheets to agent software toolkits, the relationship between ABMS and traditional techniques, and special challenges such as data and validation requirements.

■ TC28

H-Room 500, Fifth Floor

Network/Cargo Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Mikhail Nediak, School of Business, Queen's University, 143 Union str., Kingston, ON, K7L 3N6, Canada, mnediak@business.queensu.ca

1 - Nonlinearly Parameterized Basis Functions for Revenue Management

Dan Adelman, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, United States of America, dan.adelman@chicagobooth.edu, Canan Uckun

For a revenue management problem, we explore a strong functional form to approximate the optimal dynamic programming value function. Whereas much of the ADP literature employs weighted combinations of non-parametric basis functions, our basis functions are nonlinearly parameterized. We provide a solution methodology to solve the resulting non-linear program.

2 - Pricing Structure Optimization in Mixed Restricted/Unrestricted Fare Environments

Joern Meissner, Lancaster University Management School, Lancaster, LA1 4YX, United Kingdom, joe@meiss.com, Arne Strauss

Recently, many traditional practitioners of revenue management were confronted with aggressive low-cost competition. In order to stay competitive, these firms responded by cutting down fare restrictions that were meant to fence off customer segments. We develop choice-based network revenue management approaches for such a mixed fare environment that can handle both the traditional opening or closing of restricted fare classes as well as handling pricing of the unrestricted fares simultaneously.

3 - An Improved Dynamic Programming Decomposition Approach for Network Revenue Management

Dan Zhang, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, dan.zhang@mcgill.ca

We consider a nonlinear non-separable functional approximation to the value function of a dynamic programming formulation of the network revenue management (RM) problem with customer choice. We propose a solution approach and show that the approach leads to a tighter upper bound on revenue than some known bounds in the literature. Our approach can be viewed as a variant of the classical resource-based dynamic programming decomposition approach. We report encouraging numerical results.

4 - Cargo Revenue Management with Flight Combination Allotments and Consumer Choice Behavior

Mikhail Nediak, School of Business, Queen's University, 143 Union Str., Kingston, ON, K7L 3N6, Canada, mnediak@business.queensu.ca, Yuri Levin, Huseyin Topaloglu

We consider a problem faced by an airline that operates parallel flights to transport cargo between groups of OD pairs. The airline can sell its capacity either through allotment contracts on the combination of flights or on the spot market with sales subject to consumer choice behavior. The goal is to choose allotment contracts among available bids, assign these contracts to flights, and find a booking control policy for the spot market so as to maximize the total expected profit.

■ TC29

H-Room 501, Fifth Floor

Uncertainty, Renewables, Transmission and the New Zealand Electricity Market

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 - Production Inefficiency of Markets with Hydro Generation

Andy B. Philpott, Professor, University of Auckland, 70 Symonds Street, Auckland, New Zealand, a.philpott@auckland.ac.nz, Golbon Zakeri, Geoff Pritchard, Javad Khazaei

Electricity market designs that decentralize decision making for participants can lead to inefficiencies in the presence of nonconvexity or missing markets. We describe the results of an empirical study of the New Zealand wholesale electricity market that attempts to identify and quantify the sources of any productive efficiency losses, by comparing market outcomes with a counterfactual central plan.

2 - Intermittent Generation and Capacity Expansion in the Electricity Sector: A MIP-based Analysis

Phil Bishop, Senior Economist, Electricity Commission, Level 7 ASB Bank Tower, P.O. Box 10041, Wellington, 6143, New Zealand, Phil.Bishop@electricitycommission.govt.nz, Erwan Hemery

The New Zealand electricity sector is characterized by a long, radialized grid with load and generation capacity largely spatially separated. Intermittent renewables, particularly wind, will account for a significant share of future generation capacity. Moreover, much of it will be located some distance from the existing grid. Transmission investment and transmission pricing policies in this environment are analyzed using a large MIP model.

3 - Scenario Generation for Wind Power Production

Geoff Pritchard, University of Auckland, Dept of Statistics, Private Bag 92019, Auckland, New Zealand, g.pritchard@auckland.ac.nz

Power-system optimization problems are sometimes formulated with a collection of scenarios for wind power generation, rather than a single best forecast. These scenario-sets need to be different at different times, because some meteorological situations are inherently more uncertain than others. We use a quantile regression technique to generate scenarios of this kind for short time horizons (less than 6 hours).

4 - Carbon Charges in Electricity Market with Transmission Capacities

Anthony Downward, Mr, University of Auckland, 70 Symonds Street, CBD, Auckland, New Zealand, a.downward@auckland.ac.nz

We examine the effect that introducing a carbon tax may have on electricity markets. We model generators as Cournot players over an electricity grid with line capacities. The impact that a charge for Carbon emissions has on the behaviour of the generators is compared under two different assumptions about generators' rationality. We find that in certain situations total social welfare increases after the tax is applied, however it is possible that emissions of carbon dioxide can also increase.

■ TC30

H-Room 502, Fifth Floor

Underground Mining Applications

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 - A Stochastic Approach for Copper Mine Planning

Felipe Carvalla, Universidad de Chile, lcarvall@vtr.net, Antonio Alonso, Laureano Escudero, Monique Guignard, Andres Weintraub

We consider the problem of planning mine extraction under uncertainty in the price of copper. We use aggregated data from a large underground mine in Chile. We consider different price scenarios over a five year horizon, and use a stochastic integer programming approach. Lagrangean relaxation, solved via the volume algorithm, is used to handle the nonanticipativity constraints. In our computational tests, the approach compares favourably relative to a deterministic approach.

2 - Long-Term Extraction and Backfill Scheduling in a Complex Underground Mine

Donal O'Sullivan, Graduate Student, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, dosulliv@mines.edu, Alexandra Newman

We present an integer programming model to optimize the production schedule for a complex underground mining operation. The mine managers seek to maximize the amount of metal through the mill while employing a variety of mining methods to extract the ore. In addition, backfilling of mined areas is often required. The optimized long-term schedule forms the basis for a short term schedule that allows certain aspects of the operation to be considered in more detail.

3 - Optimizing Exploitation Sequences for Sublevel Caving Mines

Nelson Morales, Instituto de Innovación en Minería y Metalurgia, Avenida del Valle 738, Ciudad Empresarial Huechuraba, Santiago, Chile, NMora002@im2.codelco.cl, Maurice Queyranne, Ernesto Arancibia

Sublevel caving is done in parallel galleries, each exploited in a fixed direction. There are several galleries per level and many levels, so successively lower levels are developed as the top ones deplete. We present a model that maximizes the NPV of the exploitation sequence of a sublevel caving mine under production capacity, connectivity and subsidence constraints. We show how to reduce problem size and develop solution heuristics.

■ TC31

H-Room 503, Fifth Floor

Pricing and Choice Based Revenue Management Models in the Hospitality Industry

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Carrie Queenan, University of Notre Dame, 379 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, c_queenan@nd.edu

1 - Dynamic Versus Daily Fixed Opaque Pricing

Kristine Xie, PhD Student, The School of Hotel Administration, Cornell Univeristy, 80G Statler Hall, Ithaca, NY, 14850, United States of America, xkx2@cornell.edu, Chris Anderson

In opaque pricing certain characteristics of the service are hidden from the consumer until after purchase. We use a nested logit model in combination with logistic regression and dynamic programming to illustrate how a service firm can optimally set opaque prices. We compare optimal prices and expected revenues when dynamic pricing is restricted to daily price changes. We provide an example using data from an opaque selling mechanism (Hotwire.com) and a Washington DC based hotel.

2 - Network Price Optimization for Passenger Travel and Hospitality Industries

Pelin Pekgun, Solution Architect, OR, JDA Software Group, 1090 Northchase Pkwy, Suite 300, Marietta, GA, 30067, United States of America, pelin.pekgun@jda.com

Traditional revenue management methods offer limited insight into the dynamics of highly competitive markets, where customers have increasing visibility of prices. We describe a new approach, network price optimization, which brings competitor prices into the heart of optimization. Instead of the traditional approach of managing product availability through inventory controls, prices are directly managed based on available inventory, market reference price and the price sensitivity of customers.

3 - Integrating Choice-based Models with Capacity-based RM Routines for a Hotel

Mark Ferguson, Georgia Tech, 800 West Peachtree St, Atlanta, GA, 30308, United States of America, mark.ferguson@mgt.gatech.edu, Laurie Garrow, Melike Meterelliyoz

This paper investigates choice-based control policies for RM for multi-product industries. The addition of multiple product types complicates the choice-based RM problem. We develop several new methodologies and extensions to the single-product choice-based RM case and compare the performance of these extensions against traditional RM techniques using actual hotel industry data.

■ TC32

H-Room 504, Fifth Level

Finance

Contributed Session

Chair: Alper Corlu, Citi, 388 Greenwich, New York, United States of America, alper.corlu@citi.com

1 - An Affine Pricing and Hedging Model for European Equity Derivatives

Alexander Wugalter, Graduate Student, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, wugalter@princeton.edu, Patrick Cheridito

We consider an affine market model of a stock with stochastic volatility, stochastic interest rates and possibility of jump-to-default. This market can be made complete by taking the following four assets: stock, liquid vanilla option, a corporate and a government bond. We take an analytical approach towards pricing and hedging of European claims and propose a use of a combination of Fourier methods and direct calculation via pricing PDE.

2 - Constant Volatility Approximations for American Option Pricing in a Stochastic Volatility Model

Manisha Goswami, Research Analyst, University of Notre Dame, 370 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, mgoswam1@nd.edu, Farid AitSahlia, Suchandan Guha

In this paper we show how to adapt the numerical integral equation approach for American option pricing under the classical Black-Scholes-Merton context of constant volatility to the stochastic volatility model of Heston (1993). Our extensive numerical and empirical results demonstrate that this fast approach is also very accurate.

3 - Selling Financial Assets at the Right Time

Xun Li, Assistant Professor, Department of Applied Mathematics, Hong Kong Polytechnic University, Kowloon, Hong Kong, Hong Kong - PRC, malixun@inet.polyu.edu.hk

The process hitting the given target or early-exercise problems such as American-style derivatives is F_t-adapted. However, in real applications, particularly in dealing with selling financial assets at the right time, one usually runs into an optimal stopping time problem which is non-standard F_t-adapted. This is an interesting, but mathematically challenging, problem.

4 - A Study on the Impact of Dividends on Chinese Stocks

Xavier Pan, Associate Professor, Sun Yat-Sen University, Lingnan College, Guangzhou, China, panxpapers@gmail.com

Dividend effects have been fully studied in developed markets. However, emerging markets often have some unique features and are worth examining more. In this paper, we investigate the impact of dividend payout announcement on the stock prices and returns of companies listed in Chinese A share market. We use several ways to measure the returns and study events of dividend announcement and payment. Despite of the major similarities, interesting findings exist in the Chinese market.

5 - Analysis of the Stochastic Volatility and Jump-risk Premiums

Alper Corlu, Citi, 388 Greenwich, New York, United States of America, alper.corlu@citi.com, Yildiray Yildirim

In this study, we examine the stochastic volatility and jump-risk premiums implied by the S&P 500 index options. Model parameters were extracted using GLS. The results were compared to that of 1987 stock market crash.

■ TC33

H-Room 505, Fifth Floor

Economics Models in Supply Chains

Cluster: Economic Models in Operations Management
Invited Session

Chair: Yusen Xia, Georgia State University, Robinson College of Business, Atlanta, GA, mgtyxx@langate.gsu.edu

Co-Chair: Karthik Ramachandran, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, karthik@cox.smu.edu

1 - Impact of Low End Competition with a Strategic Supplier
Liwen Chen, PhD Candidate, The University of Texas at Austin, Department of IROM, McCombs School of Business, Austin, TX, 78703, United States of America, liwen.chen@mail.utexas.edu, Steve Gilbert, Yusen Xia

We consider how the entry of a lower quality rival affects an incumbent OEM when there are strategic suppliers. We find that if the rival's quality is intermediate, his entry can benefit the incumbent OEM. In addition, we identify the trade-off among strategic priorities that exists when the incumbent invests in capacity prior to the entry of a rival. While an aggressive investment in capacity may discourage the entry of a rival, it may also induce strategic suppliers to seek higher margins.

2 - Trade-in, Leasing, and Technology Innovation
Kate Li, Pennsylvania State University, jzl120@psu.edu, Susan Xu

Trade-in and leasing are two strategies that companies can adopt to shorten consumers' upgrade cycle and gain control over secondary markets. In this paper, we consider a monopolistic manufacturer who offers a technology product developed under a stochastic innovation process to a market consisting of heterogeneous consumers. We derive the optimal prices for the two strategies: selling with trade-in option and concurrent selling and leasing, and compare them under different scenarios.

3 - The Value of Commitments When Dealing with Strategic Customers, a Supply Chain Perspective
Ali K. Parlakturk, Assistant Professor, UNC Kenan-Flagler Business School, McColl Bldg S4708, Campus Box 3490, Chapel Hill, NC, 27599, United States of America, Ali_Parlakturk@unc.edu, Onur Kabul

We consider a supply chain composed a manufacturer and a retailer selling to forward looking customers. The customers are strategic in that they conjecture the retailer's future prices and time their purchases to maximize their utility. We solve for the optimal pricing for the manufacturer and the retailer in the face of such strategic customer behavior and evaluate the value of price and quantity commitments for the manufacturer and the retailer.

■ TC34

H-Room 520, Fifth Floor

Facility Location for Humanitarian Response

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Jessica Heier Stamm, Doctoral Candidate, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332-0205, United States of America, jheier@isye.gatech.edu

1 - Efficient Utilization of Mobile Facilities in Humanitarian Logistics
Russell Halper, Ph.D. Candidate, AMSC Program, Department of Mathematics, University of Maryland, College Park, MD, United States of America, russ@math.umd.edu, S. Raghavan

Mobile facilities can be used to efficiently provide relief when demand varies spatially and temporally. These mobile facilities could be mobile clinics, mobile communication facilities (e.g. portable cellular base stations), or mobile warehouses. The logistics problem is to determine the best strategies to route such mobile facilities to maximize the service provided. We describe a model of and heuristics for the efficient routing and utilization of mobile facilities.

2 - A Voronoi Heuristic Approach for Facility Location in Disasters
Wilfredo Yushimito, PhD Student, Rensselaer Polytechnic Institute, 110 8th Street, JEC 5107, Troy, NY, 12180, United States of America, yushiw@rpi.edu, Satish Ukkusuri, Miguel Jaller

We address the theoretical aspects of the problem of maximizing coverage of affected regions while minimizing suffering as a social cost function. We show that the social cost function is minimized at the Voronoi region enclosed around a chosen facility. A heuristic based on these diagrams is used to solve the problem.

3 - Facility Location for Foreclosed Housing Redevelopment
Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy Public Aff, McCormack Hall 3-428A, Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu, David Turcotte, Felicia Sullivan

The housing foreclosure crisis provided governments and nonprofit organizations the opportunity to purchase and rehabilitate for neighborhood revitalization. However, the cost of acquiring units for redevelopment far exceeds available funds. The current study applies best current practices in housing development to create decision models for foreclosed housing development in a large metropolitan area. We discuss modeling, implementation and policy implications of this research.

4 - Locating Humanitarian and Health Care Facilities in Systems with Self-routing Users
Jessica Heier Stamm, Doctoral Candidate, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332-0205, United States of America, jheier@isye.gatech.edu, Ozlem Ergun, Julie Swann

We study network problems motivated by humanitarian and public health scenarios. In these problems, decentralized users choose among facilities opened by a centralized planner. We present models for quantifying and improving system performance under differing individual objectives. This framework is applied to the problem of locating health clinics in Zambia that distribute HIV antiretroviral treatment. Here, decentralized decision making impacts treatment adherence and patient outcomes.

■ TC35

H-Sapphire A, Fourth Floor

Empirical Research on Health Care Operations

Sponsor: Health Applications
Sponsored Session

Chair: Anita Tucker, Assistant Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu

1 - The Impact of Manager Involvement with Process Improvement on Organizational Climate
Anita Tucker, Assistant Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu, Sara Singer

A random sample of 20 hospitals participated in an 18-month intervention to increase manager involvement in process improvement. We compared their improvement on organizational climate with 49 non-intervention hospitals. Taking action on a higher percentage of problems increased perceptions of climate while identifying problems decreased climate. Contrary to expectations, providing feedback about actions taken positively impacted managers' perceptions but negatively impacted workers.

2 - Performance Improvement of Low-volume Professional Service Work: A Multi-level Analysis
Rachna Shah, Assistant Professor, University of Minnesota, Carlson School of Management, 321, 19th Avenue South, Minnesota, MN, 55455, United States of America, shahx024@umn.edu, Susan Goldstein

Improving work done infrequently by professional service workers is challenging because volume-based learning effects cannot be utilized for process improvement. We study the effects of individual worker characteristics and organization staffing practices in community hospital emergency rooms patients when the selected diagnosis is infrequent. We find that individual professional service worker characteristics impact performance significantly and organizational staffing practices do not.

3 - Variability in Physician Ordering Practices of CTs
Jillian Berry, Doctoral Student, Harvard Business School, Wyss House, Soldiers Field, Boston, MA, 02163, United States of America, jberry@hbs.edu, Anita Tucker

This study examines the variability in physician ordering practices of head CTs in an emergency department. The time and financial effects of this variability are then analyzed.

4 - An Econometric Analysis of Patient Flows in the Cardiac ICU
Diwas KC, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, Diwas_KC@bus.emory.edu, Christian Terwiesch

This paper explores the rationing of bed capacity in a cardiac intensive care unit (ICU). We find that a patient is likely to be discharged early when the occupancy in the ICU is high. This in turn leads to an increased likelihood of the patient having to be readmitted to the ICU at a later time. We analyze the capacity implications of revisits, shedding light on the question of whether an ICU should apply an aggressive discharge strategy.

■ TC36

H-Sapphire B, Fourth Floor

Capacity Planning

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Allocation of MRI Scan Capacity in an Academic Hospital Using a Game Theoretical Approach

Maartje Zonderland, University of Twente / Leiden University Medical Center, Citadel H142, Postbox 217, Enschede, 7500 AE, Netherlands, m.e.zonderland@utwente.nl, Richard Boucherie, Judith Vink-Timmer

We develop a game theoretical model to support the allocation of MRI scan capacity among hospital departments competing over resources. Capacity is distributed according to future demands estimated by the departments. The model ensures that the departments do not provide over- or underestimations of demands, resulting in a fair allocation of capacity such that on the one hand a minimum amount of requests is rejected, and on the other hand a minimum amount of capacity is left unused.

2 - Forecasting Discharge in Patients Undergoing Neurorehabilitation

Tammy Sieminowski, University of Toronto, 580 Clinton St, Toronto, ON, M6G 2Z6, Canada, t.sieminowski@utoronto.ca

Currently, discharge dates for patients undergoing inpatient neurorehabilitation are established based on consensus professional opinion as to when a patient's functional gains are likely to plateau. Quantifying and recording functional observations routinely exchanged at multidisciplinary rounds, we established a quantitative parameter representing functional gains plateau that is associated with discharge, and developed a model that may be used to assist in forecasting discharge dates.

3 - Development and Application of a Methodology for Probability Convergence in a Healthcare System

Tze Chiam, PhD Candidate, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States of America, tzechao@purdue.edu, Yuehwern Yih

Very often there is either no true probabilities for a given system state transition, or such probabilities are unknown. A methodology developed to measure the relative entropy between probability distributions is used to determine when such probabilities are reaching convergence. As healthcare institutions often face resource shortages or overflowing demand, this methodology and the MDP are applied to a healthcare scenario to suggest appropriate actions to be taken given the system state.

■ TC37

H-Sapphire C, Fourth Floor

Flowshop Scheduling

Contributed Session

Chair: Jacques Teghem, Professor, University of Mons, Rue de Houdain,9, Mons, B-7000, Belgium, jacques.teghem@fpms.ac.be

1 - Minimizing a Quadratic Function of Job Lateness in the Stochastic Single Machine Scheduling Problem

H. M. Soroush, Associate Professor, Kuwait University, Department of Stat & Opns Res., POB 5969, Safat, 13060, Kuwait, hsoroush@kuc01.kUniversityedu.kw, F. A. Alqallaf

We study a static single machine scheduling problem in which processing times, due-dates, and penalties for not completing jobs on time are random variables. The objective is to identify an optimal sequence which minimizes the expected weighted sum of a quadratic function of job lateness. The problem is NP-hard to solve; however, we develop an exact algorithm based on a precedence relation structure among adjacent jobs. The results show that the algorithm solves large problem instances quickly.

2 - A Bi-objective Approach for Rescheduling of a Flowshop

Jacques Teghem, Professor, University of Mons, Rue de Houdain,9, Mons, B-7000, Belgium, jacques.teghem@fpms.ac.be, Daniel Tuyttens

It is necessary to integrate new jobs in a flowshop for which original jobs have been already scheduled. Two objectives are considered: a classical one(makespan, total tardiness,...) and a disruption objective(four possibilities are defined) for the original jobs. A multi-objective simulated annealing is used to approximate the set of efficient schedules. Numerical results are analyzed.

3 - Approximation of Stochastic Production Line Models of Continuous Material Flow to the Discrete Models when the System Consists of Multiple Workstations and Finite Buffers

Mohammad Quasem, Associate Professor, Howard University, Washington DC 200059, United States of America, mquasem@howard.edu

A production line is a set of subsequent operations in factory work stations where raw materials are processed to produce a product that is suitable for consumption or produce components that are assembled to make an end product. Inefficiency in a production line becomes a factor when workstations are starved or blocked; as a remedy buffers are used to ensure that the workstations are not blocked or starved. The installation of the buffer increases efficiency. In a production line if the work pieces are discrete where the service time at each station is constant and the same, then the number of possible system states increase rapidly with buffer capacities. In this circumstance, it is cumbersome to find the steady-state probabilities as the buffer capacity increases. In this study a method will be developed so that discrete production line models can be approximated by the continuous production line model. This approximation model will be used to measure the productivity improvement of the manufacturing system.

■ TC38

H-Sapphire D, Fourth Floor

Inventory Management and Applications

Cluster: Inventory Management
Invited Session

Chair: Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heighs, United States of America, yingdong@us.ibm.com

1 - Project-Driven Supply Chains (PDSCs): Integrating Inventory Planning with Project Management

Yao Zhao, Associate Professor, Rutgers University, 180 University Ave, Newark, United States of America, yaozhao@andromeda.rutgers.edu

We consider strategic planning of recurrent capital projects and their material supplies over an extended period of time. Rather than the traditional project-based approach (managing each project separately) or the recent supply-based approach (leveraging the need of multiple projects on a continuing basis), we develop an integrated approach — PDSC — to integrate supply chain lead time/safety stock planning with project management.

2 - Partially Observed Lost Sales (POLS)

Metin Cakanyildirim, University of Texas at Dallas, Dallas, TX, metin@utdallas.edu, Annabelle Feng, Alain Bensoussan, Suresh Sethi

Inventory literature traditionally assumed that lost sales were completely observed. Some recent models have unobserved lost sales. These two situations are extremes. The reality often lies in between where the lost sales are partially observed. We discuss partially observed lost sales (POLS) in practice and build a model taking POLS data into account.

3 - Demand Shaping through Bundling: A Dynamic Multiproduct Inventory-Pricing Model

Zhengliang Xue, IBM T.J.Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, zxue@us.ibm.com, Jeannette Song

We analyze the optimal joint inventory, pricing, and bundling decisions for a firm over a finite horizon. A product can be either a single component or a package of several components. We show the component complementariness, cost structure, inventory status, demand randomness and supply responsiveness drive the bundling strategy. We provide insights into when to change the bundling strategies, based on the ratio of the cost gap to the quality gap among the vertically differentiated products.

4 - Joint Inventory and Pricing Decisions for Multiple Item Inventory Products and Multiple Sales Chanel

Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heighs, United States of America, yingdong@us.ibm.com

We consider an optimization problem for joint inventory and pricing decisions for a multi-item inventory system with multiple sales channels. Both structural and numerical properties of the problems are discussed.

■ TC39

H-Sapphire E, Fourth Floor

Procurement and Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu

1 - Supply Chain Coordination for Perishable Goods with Two Periods of Shelf Life

Feryal Erhun, Assistant Professor, Stanford University, Terman Enineering Center, Room 305, Stanford, CA, 94305, United States of America, ferhun@stanford.edu, Yenho (Thomas) Chung

A manufacturer of a perishable item with two period shelf life designs contracts to sell old units along with young ones. We study three different contracts: a two-level wholesale price contract, a two-level buy-back contract, and a buy-back contract with channel rebates on old units. We demonstrate channel coordinating conditions under each of these contracts.

2 - Strategic Price Quotation by a Tier-two supplier

Bin Hu, Doctoral Candidate, University of Michigan, Ross School of Business, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, hub@umich.edu, Damian Beil, Izak Duenyas

We study price quotation decisions made by a tier-two supplier. The supplier's two potential customers compete in a reverse auction for an OEM's contract, and use the supplier's price quote as a cost input when determining their price bid. By quoting higher prices the supplier increases its potential profits but reduces the chance that either customer can meet the OEM's reserve price. We characterize the supplier's optimal pricing decisions.

3 - Supplier Quality and Relationships under Competition

Anupam Agrawal, University of Illinois at Urbana-Champaign, Champaign, IL, 61820, anupam@illinois.edu

We explore buyer supplier relationships in competitive scenarios, and study conditions under which suppliers price the same components differently to different buyers. We also study how buyers can affect this choice, and explore these conditions in the light of our empirical research in the automotive industry

4 - Optimal Ordering Under Lead Time Uncertainty and Forecast Updating

Yimin Wang, Assistant Professor, Arizona State University, Dept. of Supply Chain Management, P. O. Box 874706, Tempe, AZ, 85287, United States of America, Yimin_wang@asu.edu, Brian Tomlin

We consider a firm's procurement problem when facing lead time uncertainty and a dynamic forecasting process. Using a discrete time MDP approach, we characterize the firm's optimal procurement policy. We prove that, with multiplicative forecast revisions, the firm's optimal procurement time is independent of the demand forecast evolutionbut that the optimal procurement quantity is not. This leads to a number of important managerial insights into the firm's planning process.

■ TC40

H-Sapphire H, Fourth Floor

Scheduling, Learning and Workforce Management in a Production Environment

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Thomas Vossen, University of Colorado, 955 Regent Drive, Boulder, CO, 80309, United States of America, vossen@colorado.edu

1 - Production Scheduling and Pricing in Dynamic Stochastic Cutting Stock Applications

Harald Reinertsen, Leeds School of Business, University of Colorado at Boulder, Boulder, United States of America, Harald.Reinertsen@Colorado.EDU, Thomas Vossen

Dynamic industrial cutting stock problems give rise to new production scheduling strategies that allow large reductions in production cost. Due to the special structure of the scheduling problem, postponement and order selection strategies together with future demand approximations reduce scrap considerably while also improving due date performance. We discuss how order attributes affect production cost and offer new insights into pricing based on these attributes and the state of the system.

2 - The Effect of Learning on Manufacturing Outsourcing Decisions: A Game Theoretic Approach

Wenli Xiao, Georgia Institute of Technology, 800 W. Peachtree St. NW, Atlanta, GA, 30308-0520, United States of America, Xiao.Wenli@mgt.gatech.edu, Cheryl Gaimon

In a two-period game, a buyer determines the portion of demand to manufacture in-house versus outsource; the supplier determines the price. The supplier realizes learning from all customers. The buyer realizes learning in manufacturing and outsourcing integration cost. Also, learning enhances the buyer's revenue by improving product quality. We show how the supplier's price (buyer's outsourcing decision) is impacted by its own learning and the buyer's (supplier's) learning.

3 - Dynamic Worker Allocation in Order Fulfillment Systems

Kevin Gue, Associate Professor, Auburn University, Department of Industrial and Systems Eng, Auburn, AL, 36849, United States of America, kevin.gue@auburn.edu, Hyun Ho Kim

We describe dynamic worker allocation rules for an order fulfillment system (in most cases, a distribution center) that works against a firm, daily deadline. Success is measured by the percentage of orders arriving before a cut-off time that are finished before the deadline. We compare two rules: one based on sojourn time distributions, which we show how to compute, and a second based a simple rule of thumb.

■ TC41

H-Sapphire L, Fourth Floor

Working with Non-profit Organizations

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Louis Luangkesorn, Visiting Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu

1 - Food Banks Can Improve Their Operations with OR Tools: A Pilot Study on Pittsburgh Food Bank

Canan Gunes, Ph.D. student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, cgunes@andrew.cmu.edu, Willem-Jan van Hoeve, Sridhar Tayur

In this study we work closely 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.

2 - Supply Chain Optimization for the World Food Program

James Wade, Student, Georgia Institute of Technology, 400 17th St. NW #2409, Atlanta, GA, 30363, United States of America, j.wade@gatech.edu, Lawrence Li, Elhadj Bah, Manuel Jimenez, Ozlem Ergun, Santiago Aviles, Alvaro Morales

We will discuss our work with WFP, food aid arm of the United Nations, to improve supply chain performance in ongoing (non-emergency) operations. An inventory-ordering tool was created to help standardize inventory policies and aid in decision-making. The team also built an optimization model of the global supply chain network to investigate the effects of proposed strategic changes such as pre-positioning. Preliminary results have predicted savings and increases in service levels.

3 - Determining Resource Requirements and Staging Areas for Food Distribution in Disaster Response

Louis Luangkesorn, Visiting Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu

In 2008, the American Red Cross responded to a series of disasters across the southern United States. As operations for each event scaled up and down, resources were redeployed from operation to operation. The use of OR logistical models in disaster response is hampered by lack of available data. This work will develop a model that can estimate resource requirements and site staging locations using data that would be available during a disaster response.

■ TC42

H-Sapphire P, Fourth Floor

Sourcing in SCM

Contributed Session

Chair: Linlin Li, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, linlinli2008@u.northwestern.edu

1 - The Trade-off of Quality Improvement in a Channel with Advertising- and Quality-based Goodwill

Pietro De Giovanni, PhD Candidate, Essec Business School, Avenue Bernard Hirsch, Cergy Pontoise Paris, 95801, France, pietro.degiovanni@essec.fr

We consider a distribution channel with a single manufacturer and a single retailer where the demand depends negatively on price and positively on goodwill. The manufacturer invests in quality improvement to build up the goodwill. However, improving quality increases the production cost, thus the manufacturer faces the trade-off increasing goodwill and increasing cost. We address the question whether cooperation is beneficial for both players when such a trade-off occurs.

2 - Outsourcing to Suppliers Who Might Subcontract
Hubert Pun, Indiana University, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, hpun@indiana.edu, Hans Sebastian Heese

Firms need to take into consideration their suppliers' incentives to subcontract part of their workload. We consider a project that consists of two tasks with uncertain and potentially correlated output qualities. A manufacturer contracts with a generalist, who can perform both tasks in-house or subcontract one task with a specialist. We analyze the generalist's subcontracting incentives and its impact on the manufacturer's optimal payment, project quality and firm profitability.

3 - Analysis of Outsourcing Business Functions in Various Industries
Ramesh Bollapragada, Associate Professor, College of Business, SFSU, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu, Zeynep Yalin, Chetty Bingi, Udayabhanu Vaidyanathan

In this paper, we study the differences on the benefits, challenges risks (both current and future) of outsourcing business functions such as Manufacturing, IT, Logistics and CRM services. Results from the survey sent to 148 executives in U.S.A. at CEO, CTO, COO levels with a 42% response rate, is presented. The survey analysis allows managers to evaluate the benefits, challenges, risks and the service provider selection criteria based on the outsourced function.

4 - Transfer Strategies in the Capacity Reservation Problem
Linlin Li, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, linlinli2008@u.northwestern.edu, Seyed Iravani, Izak Duenyas

This paper considers situations where firms buy options to use the capacity of suppliers. We explore whether suppliers should provide options such that a firm that can not use all the capacity can sell it to another firm that may need the capacity. We compare three policies for the manufacturer to deal with one buyer's unused capacity and another's unfulfilled demand, and provide managerial insights into when it is optimal for the supplier to allow transfer rights with the capacity options.

■ TC43

H-Room 400, Fourth Floor

Managing Commodity Risk in Supply Chain

Cluster: Supply Chain Models
Invited Session

Chair: Lingxiu Dong, Washington University in St. Louis, Olin Business School, 1 Brookings Drive, St. Louis, MO, 63130-4899, United States of America, dong@wustl.edu

Co-Chair: Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu

1 - Optimal Managerial Compensation and Financial Hedging in Commodity Procurement
Masha Shunko, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, mshunko@andrew.cmu.edu, Nicola Secomandi, Laurens Debo, Lin Nan

Consider a firm that uses a traded commodity as input to its production process and employs a risk-averse procurement manager. We study the interaction between the firm's financial hedging policy and the manager's procurement policy, the manager's optimal compensation structure, and the sensitivity of this structure to relevant parameters. We find that the optimal bonus for the manager is nonmonotone in various parameters of interest and only medium size firms benefit from financial hedging.

2 - Capacity Management for Agricultural Commodities
Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

This paper analyzes the capacity investment portfolio of a processor that uses a single input to produce multiple products in fixed proportions. The input and each output production require dedicated capacities. The main motivation comes from agribusiness where the input and some of the outputs are commodities and are traded on the spot markets. We investigate the effect of spot price variability, correlation among different end-products on the optimal capacity investment portfolio.

3 - Effect of Term Structure of Futures Price on Spot Procurement Policies
Ankur Goel, Case Western Reserve University, ankur.goel2@case.edu, Genaro Gutierrez

In this research, we explore the effect of term structure information of futures prices on the procurement policies from the spot market. We compare one-factor stochastic price model with a two-factor model to quantify the benefits of higher term structure model on operating policies. We conclude that for gasoline the two factor price model leads to substantial inventory cost savings. In addition, the frequent calibration of the price process has marginal benefit.

4 - Value of Processing Flexibility in Uncertain Input and Output Markets
Xiaole Wu, Ph.D. Candidate, Olin Business School, One Brookings Drive, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Lingxiu Dong, Panos Kouvelis

We consider a processing plant that takes in commodity inputs at various quality levels and processes them into intermediates that will be blended into various outputs. We focus on a specific type of processing flexibility that is used in the oil refinery industry, that is, converting low quality intermediates to high quality ones. We examine the value of such operational flexibility in an environment where input and output prices are volatile.

■ TC44

H-Room 402, Fourth Floor

Advanced Modeling Methods for Health and other Services

Sponsor: Service Science
Sponsored Session

Chair: Kalyan Pasupathy, Assistant Professor, University of Missouri, CE732 CS&E Building, Five Hospital Drive, Columbia, MO, 65212, United States of America, pasupathyk@missouri.edu

1 - Streamlining Patient Flow in Surgical Services
Mustafa Sir, Assistant Professor, University of Missouri, Industrial and Manufacturing Systems Eng, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, sirm@missouri.edu, Kalyan Pasupathy, Luis Occena, Rung-Chuan Lin, Eric Miedema

Hospital management often puts pressure on the surgery department to increase patient throughput. However, management often fails to consider the effect of capacity of pre- and post-surgical resources. Instead of solely focusing on the efficiency of operating rooms, we view the entire surgical services as a large system from admission to discharge. Our model provides valuable insights into resource allocation across different stages of the surgery process and its effect on the throughput.

2 - Simulation and Network Modeling of Hospital Pharmacy Delivery
Beilei Zhang, University of Missouri, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America bztdd@missouri.edu, Kalyan Pasupathy

This project aims at optimizing internal pharmacy delivery by using a hybrid modeling approach combining simulation and network modeling. The simulation modeling is used to build stochastic scenarios of the operations within inpatient pharmacy and measure performance, while the mathematical model defines the delivery network of the various units. By comparing different scenarios, the most suitable networking strategy can be identified.

■ TC45

H-Room 410, Fouth Floor

New Product Development I

Contributed Session

Chair: Sidharth Rupani, PhD Candidate, MIT, 550 Memorial Drive, Apt. 23B4, Cambridge, MA, 02139, United States of America, sidrup@mit.edu

1 - Aligning Sources of External Knowledge in New Product Development with Choice of Generic Strategy
Fabrizio Salvador, Professor, Instituto de Empresa, C/Maria de Molina 11, Madrid, 28006, Spain, Fabrizio.Salvador@ie.edu, Anil Akpinar

In NPD literature, it has been already acknowledged that firms should acquire knowledge from external sources to complement their internal knowledge. In this paper we explore the role of generic strategies in deciding which external sources to use for a superior innovation performance. We hypothesize and provide empirical evidence that under differentiation strategy customer involvement will result in superior innovation performance whereas cost leadership benefits from supplier involvement.

2 - Alternative Supply Chain Management Strategies for New Product Diffusion: An ABMS Approach

Mohammad Amini, The University of Memphis, 365 Innovation Drive, Memphis, United States of America, mamini@memphis.edu, Tina Wakolbinger, Mike Racer, Mohammad Nejad

In this paper, we develop an agent-based model to simulate the effect of alternative supply chain strategies on the diffusion process of a new product. The potential demand market consists of 3,000 customers interconnected through their social network. The diffusion process is driven by positive and negative word-of-mouth, marketing efforts, and capacity restrictions. Using extensive computational experimental design, we compare the NPV of profit generated by alternative strategies.

3 - Alliance Depth, Success and Strategic Orientation of the Firm: Evidence From the Biotech Industry

Manpreet Hora, Assistant Professor, Georgia Institute of Technology, 800 W Peachtree St. NW, Atlanta, GA, 30328, United States of America, manpreet.hora@mgt.gatech.edu, Devkamal Dutta

We study the role alliance partnerships between biotech entrepreneurial firms and mainstream drug companies play in ensuring entrepreneurial success through the product development life-cycle for introduction of new drugs. Examining over 1000 alliances in the US biotech industry spanning a five-year period (2004-2008), we investigate the relationship between alliance depth, success, and the biotech firm's strategic orientation.

4 - The Soft Resource Allocation Problem

Foad Iravani, UCLA Anderson School of Management, 110 Westwood Plaza, Suite B512, Box 951481, Los Angeles, CA, 90095-1481, United States of America, foad.iravani.2012@anderson.ucla.edu, Reza Ahmadi, Sriram Dasu

We propose a hierarchical framework for organizing and staffing a product development process at a leading software company that produces tax software. Every year, the firm struggles with a high workload imposed by thousands of changes in tax rules announced by the IRS. These changes have to be processed and incorporated into the next generation of the product by mid-December. We develop models for organizing and staffing the development activities to meet the deadline at the lowest cost.

5 - Product Development Process Standardization in Multi-Project Organizations

Sidharth Rupani, PhD Candidate, MIT, 550 Memorial Drive, Apt. 23B4, Cambridge, MA, 02139, United States of America, sidrup@mit.edu

The overarching question of this paper is 'what is the right level of variation across product development processes in a multi-project organization?' Process standardization offers learning and efficiency benefits, but process diversity could allow widely varying projects to effectively meet project targets of cost, schedule, and quality. This paper builds on a broad survey of the literature and detailed company case studies to lay out a framework to manage this tradeoff.

■ TC46

H-Room 411, Fourth Floor

KLIC II

Sponsor: Technology Management
Sponsored Session

Chair: Nile Hatch, Brigham Young University, Marriott School, 690 TNRB, Provo, UT, 84602, United States of America, nile@byu.edu

1 - The Persistence of Organizational Knowledge across Merger and Acquisition Events

Peter Madsen, Assistant Professor, Brigham Young University, 585 TNRB, Provo, UT, 84602, United States of America, petermadsen@byu.edu

The ability to gain access to new organizational knowledge is a frequently noted justification for corporate mergers and acquisitions. However, there is good reason to expect that much organizational knowledge may be lost during merger and acquisition events. In this paper, I examine the persistence of previously acquired organizational knowledge across mergers and acquisitions in the U.S. airline industry.

2 - The Pharma/Biotech Innovation Conundrum: R & D Spending Up, No. of Drugs Down

Tom Hill, Principal, The Leverage Innovation Group, 1677 Honfleur Drive, Sunnyvale, CA, 94087, United States of America, thill@leverageinnovation.com

This paper identifies the challenge facing the healthcare industry in terms of research and development productivity. While the industry has doubled spending in R & D in the past 9 years, the number of drugs actually approved has dropped in half. The paper identifies strategic issues that contribute to this lack of productivity, and the role that innovation pathways play toward a solution.

3 - Social Network Ties, Transactive Memory, and Performance in Groups

Kyle Lewis, Associate Professor, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, kyle.lewis@mccombs.utexas.edu, Jeong-Yeon Lee, Daniel Bachrach

We use transactive memory systems (TMS) theory to explain what drives the effects of certain social network structures in small groups. We examine the combined effects of reciprocity and the number of 'axis' members and TMS on team performance. We find that different network structures differentially affect TMSs and performance. The implications of the results from this experiment for theory, as well as practice are developed.

4 - Information Velocity and Competitive Advanatage

Nile Hatch, Brigham Young University, Marriott School, 690 TNRB, Provo, UT, 84602, United States of America, nile@byu.edu, Michael Miles, Ryan Williams, Alex Cavallini

Information velocity is the ability to respond correctly to uncertain market demand. Manufacturers that transform information into offerings faster than rivals earn competitive advantages through lower costs, growing revenues, and price premia. We find that lean manufacturers have greater information velocity and enjoy 2.5 times greater returns than non-lean firms with lower information velocity. This result is strengthened in markets with high demand volatility.

■ TC47

H-Room 412, Fourth Floor

Outsourcing Governance, Capabilities, and Outcomes

Cluster: Global Sourcing of Services
Invited Session

Chair: Rajiv Kishore, SUNY at Buffalo, School of Management, Buffalo, NY, 14260, United States of America, rkishore@buffalo.edu

1 - Rewards and Penalties in IT Outsourcing: When are They Used and do They Work as Intended?

Rajiv Kishore, SUNY at Buffalo, School of Management, Buffalo, NY, 14260, United States of America, rkishore@buffalo.edu, Matthew Swinarski

Recent studies have shown that the contract itself as well as past vendor performance have an impact on trust and relational governance in contractual relationships. We extend this literature by studying the impact of exercise of rewards and penalties (that may or may not be specified in the contract) on trust and relational governance.

2 - The Effects of Relationship, Governance, Knowledge Factors on IS Outsourcing Effectiveness

Balaji Sankaranarayanan, Bentley University, 175 Forest street, Waltham, United States of America, bsankara@bentley.edu

Applying RBV of strategic relationships and organizational learning theories, this research develops and tests hypotheses based on a research model of relationship, governance, and learning factors, and their impacts on application development outsourcing effectiveness, from the client perspective. A field survey of client-side IS managers was conducted to test the hypotheses using PLS. The results of this study have prescriptive value for academics and practitioners alike.

3 - Modular Architecture, Task Disaggregation and Incentives in 'Software as a Service'

Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu, Anitesh Barua

A key challenge in service disaggregation is knowledge interdependencies across client and provider organizations that results in a multitask agency problem involving the lack of verifiability of certain tasks. Our key research questions involve (i) the suitability of incentives in contracts when the outsourced task has multiple dimensions or facets that differ in verifiability, and (ii) how such contract choice is affected by the modularity of interfaces between the client and the provider.

■ TC48

H-Sapphire Green Room, Fourth

Advances in Teaching Service & Retail Operations

Cluster: Service Operations Management
Invited Session

Chair: Nicole DeHoratius, University of Portland Pamplin School of Business, Zaragoza Logistics Center, Portland, United States of America, dehorati@up.edu

Co-Chair: Zeynep Aksin, Koc University, Istanbul, Turkey, zaksin@ku.edu.tr

1 - Teaching Global Dual Sourcing: Mexico-China Game
Jan Van Mieghem, Professor, Kellogg-Northwestern University, MEDS dept, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, vanmieghem@kellogg.northwestern.edu, Gad Allon

We consider a firm with access to a responsive local source and a cheap but remote source. The firm must determine a sourcing strategy to satisfy random demand over time. To transfer recent academic insights to the classroom, we present a game where student teams place orders to both sources over time and manage inventory and their bank account. We analyze the student policies along both financial and operational metrics, present the optimal strategy, and summarize the learning points.

2 - "Innovience" - The Integration of Innovation & Science
Mike Cramer, Director, Operations Research, McDonald's Corporation, 1253 North Schmidt Road, Romeoville, IL, 60446, United States of America, mike.cramer@us.mcd.com

The McDonald's Innovation Center tackles Global Business Issues on a daily basis. With over 2,000 customers per year, there needs to be a way to connect, be predictive & influence thinking to accelerate the decision making process. This talk will be centered around the new concept of "Innovience" which is the integration of innovation & science to accelerate the process of reaching concensus and aligned decision making.

3 - Should You Teach a Service Operations Class?
Don Eisenstein, Professor, University of Chicago, Booth School of Business, 5807 So Woodlawn Ave, Chicago, IL, 60637, United States of America, Don.Eisenstein@chicagobooth.edu

Typically, the topics covered in a service operations class is a subset of a core operations class. I will discuss why I think this is a mistake, and illustrate with a small case I wrote. I will also discuss my experiences in general in developing a service operations course.

4 - Teaching Service Operations to Service-oriented Undergraduate Students
Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

Cornell's School of Hotel Administration offers a unique undergraduate program which blends business education with the specific needs of hospitality and service industry. The students of this program are extremely bright and very aware of the needs and demands of a service-based organization. While exciting, this environment presents unique challenges to the instructor. We will discuss some of the lessons learnt in teaching in this program during the last few years.

■ TC49

H-Room 300, Third Floor

Supply Chain Decisions to Manage Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Kathryn Stecke, Ashbel Smith Professor, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, kstecke@utdallas.edu

1 - The Effect of Stochastic Dependency in Supply Disruptions on Supply Chain Performances
Behdad Masihtehrani, PhD Student, Penn State University, Department of Industrial Engineering, University Park, PA, 16802, United States of America, behdad@psu.edu, Soundar Kumara, Susan Xu

We consider how stochastic dependency in supply disruptions affects supply chain performances. We show that while positive stochastic dependency in supply disruptions has adverse effects on the cost and fill rate of a multi-source supply chain, it has favorable effects on these measures in an assembly supply chain. We discuss how such stochastic dependency affects retailers' inventory policies in these two network settings.

2 - Coordinating Supplies and Infrastructure for Disaster Relief
Amiya Chakravarty, Northeastern University, 360 Huntington Ave, Boston, United States of America, A.Chakravarty@neu.edu

We study a hybrid strategy combining proactive and reactive decisions. The relief provider decides relief quantity to purchase from the retailer who determines the price, and sets up a contract for infrastructures services by specifying a repair delay he would be willing to tolerate; the service provider determines the amount of incentive-subsidy she would require for upgrading the infrastructure.

3 - Sustainable Container Transport by Disruption Management
Rob Zuidwijk, Associate Professor, Rotterdam School of Management, Erasmus University, P.O. Box 1738, Rotterdam, 3062 PA, Netherlands, rzuidwijk@rsm.nl, Albert Veenstra, Jan van Dalen

Based on our findings from a large project with industry, we aim to quantify how container transport can be made more secure, efficient, and environmentally friendly. By means of a model, we study how data captured in the supply chain and response measures create opportunities to make better trade-offs between these objectives. We also pay attention to some of the implementation issues in a real life setting.

■ TC50

H-Room 302, Third Floor

Managing Service Systems: Some Insights on Scheduling, Capacity Planning and Pricing

Sponsor: MSOM/ Service Management
Sponsored Session

Chair: Ramandeep Randhawa, University of Sourthern California, Los Angeles, CA, United States of America, Ramandeep.Randhawa@mccombs.utexas.edu

1 - Modeling Abandonment From an Emergency Department
Ehsan Bolandifar, Washington University in St. Louis, 1 Brookings Dr., St. Louis, MO, 63130, United States of America, bolandifar@wustl.edu, Tava Olsen

We address modeling and analysis of patient abandonments due to excessive delays from an emergency department. While addressing certain data-related issues caused by censored sampling, we model our problem as an M/G/n system with abandonment in order to evaluate investment in decreasing patient boarding caused by the main hospital.

2 - When the c\mu Rule is not Optimal
Amy Ward, USC, Marshall School of Business, BRI401H, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu

We consider the problem of how to dynamically schedule waiting customers for service in a single server queue with multiple impatient customer classes. Each customer class is willing to pay a specified amount for his service, but will abandon the queue without paying if he is not served within a generally distributed amount of time. We show that a threshold-type, non-greedy policy is nearly optimal for a system in which the server is heavily utilized.

3 - Services Cloud Pricing: Dynamic Pricing of Computing Resources for a Reservation System
Denis Saure, Columbia University, 3022 Broadway, Uris Hall, 4N, New York, NY, 10025, United States of America, dsaure05@gsb.columbia.edu, Hani Jamjoom, Assaf Zeevi, Anshul Sheopuri, Huiming Qu

We study a reservation system for computing resources over a finite horizon, where users submit reservation requests in advance. Each user is allocated a limited number of tokens which can be exchanged for computing time. The objective is to maximize system performance by (dynamically) adjusting token prices per unit of computing time. We propose pricing policies that smooth demand over the horizon, and discuss its implementation in a "Cloud" for high performance computing being developed by IBM

■ TC51

H-Room 303, Third Floor

Computational Linear and Integer Programming

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Yan Xu, Analytical Solutions Manager, SAS Institute Inc., SAS Campus Drive, Cary, United States of America, Yan.Xu@sas.com

1 - Microsoft Solver Foundation
John Oberon, Director of Program Management, One Microsoft Way, 4/2194, Redmond, WA, 98052-6399, United States of America, John.Oberon@Microsoft.com

Solver Foundation is a pure, managed code runtime for mathematical programming, modeling, and optimization. This .NET/CLR based framework provides a rich set of tools, services, and engines. We will focus on our computational integer programming effort - a branch and cut solver based on Dual Simplex, and is designed to enable 64-bit and multi-core computation environments. We will discuss advanced presolve, Gomory mixed integer cuts, mixed integer rounding cuts, and local search heuristics.

2 - Solving Linear Optimization Problems with MOSEK
Bo Jensen, MOSEK ApS, C/O Symbion Science park Fruebjergevj 3, Copenhagen, Denmark, bo.jensen@mosek.com

The software package MOSEK is capable of solving large-scale sparse linear optimization problems using either an interior-point, a primal simplex or a dual simplex algorithm. The aim of this talk is to present the linear optimizers and the recent advances in their implementation. Moreover, we will present numerical results demonstrating the optimizers performance.

3 - Cutting Planes in SAS MILP Solver
Amar Narisetty, SAS Institute, SAS Campus Drive, Cary, United States of America, Amar.Narisetty@sas.com, Yan Xu

The SAS MILP solver implements a branch-and-cut algorithm for solving large scale mixed integer linear programs. In this talk, we give an overview of the families of cutting planes currently incorporated in the SAS MILP solver. These include, GMIC, MIR, Covers, Cliques, etc. We present computation results to demonstrate the effectiveness and contribution of each family of cutting planes in solving some well known instances.

4 - IBM ILOG CPLEX Technology Update
John Gregory, ILOG CPLEX Product Manager, IBM ILOG Optimization, 889 Alder, Suite 200, Incline Village, NV, 89451, United States of America, jgregor@us.ibm.com

This talk will highlight the recent major enhancements in IBM ILOG CPLEX, covering both solution speed and usability features. Details on MIP benchmarking results will be provided. The latest information about the integration of ILOG and its products into the greater IBM optimization community will also be shared.

■ TC52

H-Room 304, Third Floor

Supply Chain Competition and Coordination

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Tieming Liu, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74074, United States of America, tieming.liu@okstate.edu

Co-Chair: Biying Shou, City University of Hong Kong, Tat Chee Ave., Kowloon, Hong Kong - ROC, biying.shou@cityu.edu.hk

1 - Duopoly Competition on Prices and Customer Acquisition
Xiaona Zheng, Peking University, Guanghua School of Management, Peking University, Beijing, 100871, China, xzheng@gsm.pku.edu.cn, Xiting Gong

In this paper, we study a duopoly model where two firms compete on prices and customer acquisition investment. We consider factors such as market concentration and product differentiation. We find mixed results for the equilibrium structures and show that two firms engaging in customer acquisition competition may encounter the prisoner's dilemma.

2 - Sales Effort Free Riding and Coordination with Price Match and Selective Compensation Rebate
Dahai Xing, Oklahoma State University, 502 Engineering North, Stillwater, 74078, United States of America, dahai.xing@okstate.edu, Tieming Liu

This paper studies sales effort coordination for a supply chain with one manufacturer and two retail channels, where an online retailer offers a lower price and free-rides a traditional retailer's sales efforts. We designed a contract with price match and selective compensation rebate. The numerical analysis shows that such a contract can achieve a supply chain efficiency approximating that of an integrated supply chain.

3 - Product Information Free Riding between On-line Retailers and Coordination with Reward-per-Click
Tieming Liu, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74074, United States of America, tieming.liu@okstate.edu, Xianjun Geng

We study a supply chain setting with one manufacturer and two on-line retailers. One retailer free-rides the product information (e.g. product specifications and customer reviews) provided on the other retailer's website. Providing the product information is costly for on-line retailers, and thus the free-riding hurts the supply chain performance. We investigate how a reward-per-click contract offered by the manufacturer coordinates the supply chain.

4 - Managing Supply Uncertainty of Wireless Network
Biying Shou, City University of Hong Kong, Tat Chee Ave., Kowloon, Hong Kong - ROC, biying.shou@cityu.edu.hk, Jianwei Huang, Lingjie Duan

We study a three-tier wireless supply network model consisting of a spectrum holder, a wireless network operator, and a set of end-users. The network operator obtains its capacity by leasing or sensing spectrum from the spectrum holder, and then sells it to the end-uers. Due to the nature of cognitive spectrum sensing, the capacity outcome is unreliable. We establish a decision model and derive the optimal capacity investment and user-pricing decisions at the equilibrium.

■ TC53

H-Room 305, Third Floor

New Integer Programming Applications

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov

1 - Color Codes and Integer Programming for Fault-tolerant Quantum Computation
Jonas Anderson, University of New Mexico, 800 Yale Blvd NE Albuquerque, Albuquerque, NM, 87131-0001, United States of America, jander10@unm.edu, Andrew Landahl

In a quantum computer, physical quantum bits (qubits) interact with the environment, requiring constant error correction. In Topological color codes (TCCs) a logical qubit is encoded in many noisy physical qubits which are measured by local parity checks. Given the parity data, we use an integer program (IP) to diagnose the most likely set of errors. We simulate error patterns with Monte Carlo experiments and find a threshold for quantum computing with TCCs.

2 - Deterministic Integer-Programming Methods for Generating Graphs with Specific Properties
Vitus Leung, Senior member of technical staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, vjleung@sandia.gov, Randall Laviolette, Cynthia Phillips, Robert Carr

Our presentation is on a graph generation problem motivated by Li et al's model for the structure of some infrastructure networks. Those who study link prediction, for example, would like to generate graphs with such structure, or closely related. The integer program for this problem is straightforward except for the exponential number of constraints required to enforce that the graph is connected. However, there exists a deterministic separation algorithm to enforce graph connectivity.

3 - Moving Multiple Sinks to Maximize the Lifetime of Wireless Sensor Networks
Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov, Stefano Basagni, Alessio Carosi, Chiara Petrioli

We consider scheduling mobile data-collecting sinks in wireless networks. Sensors close to sinks expend more energy relaying messages than those far away. Sinks move to distribute load. We give a linear program that provides an upper bound on the lifetime of a network with constant data rates. We solve this LP using p-median integer programs as separators and compute a heuristic schedule from the LP solution that is within 1.4% of the upper bound for networks with hundreds of sensors.

■ TC54

H-Room 306A, Third Floor

Computing Equilibrium in Markets and Games

Sponsor: Optimization/Networks
Sponsored Session

Chair: Nikhil Devanur, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States of America, nikdev@microsoft.com

1 - Proportional Response Dynamics in the Fisher Market
Li Zhang, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, lzha@microsoft.com

We show that the proportional response dynamics converges to the market equilibrium in the Fisher market with constant elasticity of substitution (CES) utility functions. By the proportional response dynamics, each buyer allocates his budget proportional to the utility he receives from each good in the previous time period. Despite its simplicity, the dynamics converges fast for strictly concave CES utility functions, matching the bound via solving a global convex optimization problem.

2 - Fisher Markets with Transportation Costs
Chinmay Karande, PhD Student, Georgia Institute of Technology, 15046 SE 14'th St., Bellevue, WA, 98007, United States of America, ckarande@gmail.com, Sourav Chakraborty, Nikhil Devanur

We consider a natural generalization of the Fisher market model where buyers pay a transportation cost on each unit of good bought, depending upon the seller's location. The transportation costs can also be interpreted as the buyer's preferences expressed in an additive sense. We provide the proof of existence of market clearing prices in this model, as well as an algorithm to compute an \epsilon-approximate equilibrium.

3 - Settling the Complexity of Market Equilibria
Shanghua Teng, Boston University, 111 Cummington St, Boston, MA, 02215, United States of America, shanghua.teng@gmail.com

We prove that the problem of computing an Arrow-Debreu market equilibrium is PPAD-complete even when all traders use additively separable, piecewise-linear and concave utility functions. I will also discussion about the extension of this result to Fisher equilibria. Joint work with Xi Chen, Decheng Dai, and Ye Du.

4 - Convergence of Local Dynamics to Balanced Outcomes in Exchange Networks
L. Elisa Celis, University of Washington, U. of Washington, Computer Science, Box 352350, Seattle, WA, 98195, United States of America, ecelis21@gmail.com, Yossi Azar, Benjamin Birnbaum, Nikhil Devanur, Yuval Peres

Bargaining games on exchange networks have been extensively studied. A Balanced Outcome for such a game is an equilibrium concept that combines notions of stability and fairness. Recent work gave a polynomial time global algorithm to compute such outcomes. However, it left a pertinent open question: "are there natural, local dynamics that converge to a balanced outcome?" We answer in the affirmative by describing a process and showing it converges to a balanced outcome whenever one exists.

■ TC55

H-Room 306B, Third Floor

Traveling Salesman Problems

Contributed Session

Chair: Vladimir Bugera, Kammerdiner Consulting, 16031 N 31st AVE, Phoenix, AZ, 85053, United States of America, vladimir@bugera.com

1 - The Circuit Polytope
John Hooker, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, john@hooker.tepper.cmu.edu, Latife Genc-Kaya

The circuit constraint provides a very succinct formulation of the traveling salesman problem and other sequencing problems. We analyze the circuit polytope as an alternative to the traveling salesman polytope as a means of obtaining linear relaxations. We provide a nearly complete characterization of the polytope and suggest efficient separation heuristics. We also show how the circuit formulation can exploit structure in the objective function.

2 - Exact and Heuristic Solutions to the Double TSP with Multiple Stacks
Oli B.G. Madsen, DTU Transport, Technical University of Denmark, ogm@transport.dtu.dk, Claudia Archetti, Hanne L. Petersen, M. Grazia Speranza

The double travelling salesman problem with multiple stacks (DTSPMS) is a pickup and delivery problem where pickups and deliveries are separated, such that all pickup operations are performed before the first delivery takes place. All operations are carried out by one vehicle and no reloading is allowed. The vehicle provides several separated (horizontal) stacks/rows for the transportation of the orders, such that each stack is accessed using a LIFO principle, independently of the other stacks. In a real-life setting the dimensions of the problem is 33 orders each consisting of one euro-pallet, which can be loaded in 3 stacks in a standard 40 foot container. Different exact and heuristic solution approaches to the DTSPMS have been implemented and tested. The exact approaches are based on different mathematical formulations of the problem which are solved using branch-and-cut. One formulation leads to a decomposition approach, consisting of a routing master problem and a loading feasibility subproblem, which generates infeasible paths for the master problem. The latter is the most promising of the tested approaches, and solves all tested problems with up to 15 orders, as well as some larger instances. The implemented heuristics include tabu search, simulated annealing and large neighbourhood search. Particularly the LNS approach shows promising results. It finds the known optimal solution of smaller instances (15 orders) within 10 seconds in most cases, and in 3 minutes it finds solutions to 33 order instances that are on average within 1% of the best known solutions.

3 - Charlemagne's Challenge: The Periodic Latency Problem
Sofie Coene, KULeuven, Naamsestraat 69, Leuven, 3000, Belgium, sofie.coene@econ.kuleuven.be, Frits Spieksma, Gerhard Woeginger

We are given a server travelling at unit speed, and a set of clients with their positions. To each client a periodicity is associated that is the maximal amount of time allowed to pass between consecutive visits of the server to that client. In the PLPP, the goal is then to find a repeatable route for the server visiting as many clients as possible without violating the frequencies. We give polynomial-time algorithms and NP-hardness results.

4 - Traveling Salesman Problem Under Uncertainty Considerations
Konstantin Kalinchenko, Doctorial Candidate, Risk Management and Financial Engineering lab, Department of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, kalinchenkok@gmail.com, Stan Uryasev, Vladimir Boginski, Vladimir Bugera

We consider the Traveling Salesman Problems with stochastic travel times. The length of each arc is a random variable with known distribution. The objective of our exercise is to find a tour with minimum expected length while limiting impact of worst-case (tail) scenarios. Various computational experiments are reported.

■ TC56

H-Room 307, Third Floor

Algorithms and Applications of Polynomial Optimization and Robust Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: X. Andy Sun, Doctoral Candidate, Operations Research Center, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, sunx@MIT.EDU

1 - Efficient First-Order Methods for Polynomial Optimization
X. Andy Sun, Doctoral Candidate, Operations Research Center, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, sunx@MIT.EDU, Dimitris Bertsimas, Robert Freund

We apply efficient first-order methods to polynomial optimization problems (POPs), which are generally difficult to solve. By exploiting special structure of the SDP representation of the POP, we demonstrate that first-order methods have the promise to improve the computational solvability of general POPs. We also explore techniques for solving sparse problems that greatly enhance computational efficiency.

2 - Semidefinite Relaxations for Multistage Robust Optimization and Stochastic Programming
Dan Iancu, Doctoral Candidate, Operations Research Center, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, daniancu@mit.edu, Pablo A. Parrilo, Dimitris Bertsimas

In this work, we introduce a new framework for computing near-optimal policies for multi-stage robust optimization and stochastic programming problems, based on solving a single semi-definite programming relaxation. We demonstrate the performance of the resulting policies numerically, in the context of two classical inventory management applications.

3 - Models for Minimax Stochastic Linear Optimization Problems with Risk

Xuan Vinh Doan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, vanxuan@mit.edu, Dimitris Bertsimas, Karthik Natarajan, Chung-Piaw Teo

We study the minimax stochastic optimization problem with a moment-based distribution class. We show that the model is tractable for problems with random objective and some special ones with random right-hand side. We provide explicit worst-case distributions and compare minimax solutions with data-driven solutions under contaminated distributions. Computational results show minimax solutions hedge against worst-case distributions and provide lower variability in cost than data-driven ones.

■ TC57

H-Room 308, Third Floor

Scheduling of Patients/Physicians in Clinics

Sponsor: Health Applications

Sponsored Session

Chair: Sangbok Lee, Purdue University, School of Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, lee309@purdue.edu

1 - Analysis on Advanced Appointment Systems in Outpatient Clinics: Open Access and Overbooking

Sangbok Lee, Purdue University, School of Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, lee309@purdue.edu, Jong-hyun Ryu, Daiki Min, Yuehwern Yih

Open Access and Overbooking policy are two well-known advanced appointment systems in outpatient clinics. In this study, we investigated different configurations of the two systems in various clinical environments. The performances of the two systems are, then, compared in terms of patients throughput and clinic overwork. Finally, a better hybrid model of the two systems was demonstrated for each clinic environments. A single server simulation model was developed for this study.

2 - A Multi-Stage Stochastic Programming Model for Appointment Scheduling Under Uncertainty

Ayca Erdogan, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, saerdoga@ncsu.edu, Brian Denton

We discuss a multi-stage stochastic programming model to determine the optimal arrival times to a stochastic server given uncertainty in the number of customers to be scheduled. We also describe heuristics for the dynamic appointment sequencing problem, and present empirical results based on optimal scheduling of an endoscopy suite. We discuss the structure of the model, methods for accelerating decomposition based solution methods and specific applications to the outpatient clinic setting.

3 - Physician Scheduling to Improving Spatial Access for Outpatient Specialty Care

Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu, Peter Fabri

Given a health care provision network that includes a few large medical centers and many local clinics, we in this research consider a problem that schedule physicians' weekly visits to local clinics for outpatient consultations. Our initial aim is to minimize patient travel distance and time. We present several integer programming models to address a number of scheduling constraints and extend the model to incorporate uncertainty in outpatient consultation requests.

4 - Emergency Department Capacity Planning for a Pandemic Scenario: Nurse Allocation

Grisselle Centeno, Associate Professor, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, gcenteno@eng.usf.edu, Florentino Rico

Data on seasonal influenza surveillance is used to forecast patient demand to the Emergency Department using time series analysis and causal models such as neural networks and regression analysis. Forecast results are used to explore a set of potential pandemic influenza scenarios. Results are used as input to a simulation model that evaluates ED capacity and What-If scenarios. We propose an optimized nurse allocation model for the different areas with the objective to improve system efficiency.

■ TC58

H-Room 309, Third Floor

Cyclic Scheduling and Robotic/Cluster Tools

Cluster: Scheduling

Invited Session

Chair: Tae-Eog Lee, Professor, KAIST, Department of Industrial & Systems Eng., 373-1 Guseong-dong, Yuseong-gu, Daejeon, Korea, Republic of, telee@kaist.ac.kr

1 - Robotic Cells with Internal Buffers: Single Gripper and Dual Gripper Models

Neil Geismar, Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, NGeismar@mays.tamu.edu, Milind Dawande, Inna Drobouchevitch, Chelliah Sriskandarajah

We consider the scheduling of robotic cells having input and output buffers at each processing machine. We show that adding internal input buffers to a single gripper cell with internal output buffers does not improve throughput. However, we define a cycle of robot moves in a dual gripper cell with both input and output buffers at each machine that can improve throughput over cells with no internal buffers. This advantage is quantified and the circumstances under which it applies are detailed.

2 - Interplay between OR and Petri Nets for Cyclic Scheduling and Robot Cell & Cluster Tool Scheduling

Tae-Eog Lee, Professor, KAIST, Department of Industrial & Systems Eng., 373-1 Guseong-dong, Yuseong-gu, Daejeon, Korea, Republic of, telee@kaist.ac.kr

Cyclic scheduling, robot cell/hoist/cluster tool scheduling, and Petri nets have been studied by OR and automation communities independently. However, all they address fundamentally equivalent systems, where each resource repeats an identical work cycle. We briefly review interplay issues between OR and Petri nets for scheduling such cyclic systems including linear and mixed integer programming, doubly weighted graphs, time window constraints, Markov chains, cyclic scheduling, etc.

3 - Algorithms for Wafer Transport in Linear Cluster Tools

Kyungsu Park, Master Student, KAIST, Department of Industrial & Systems Eng., 373- Guseong-dong, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, ks-park@kaist.ac.kr, James Morrison

We discuss scheduling algorithms for linear cluster tools in semiconductor manufacturing that address transient states. The algorithms allow for redundant modules and consider lot changes, rolling setups and module failure. The algorithm strives to maximize the cluster throughput and, within the class of such policies, to minimize residency times for wafers inside the tool. The performance of the algorithm is compared to baseline methods via simulation.

4 - An Efficient Optimization Model for Cyclic Scheduling of Cluster Tools

Chihyun Jung, Ph.D. Candidate, KAIST, Department of Industrial & Systems Eng., 373-1 Guseong-dong, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, chjung@kaist.ac.kr, Tae-Eog Lee

Cluster tools are widely used for semiconductor manufacturing. The scheduling problems tend to be more complicated due to advanced tool architectures, complex wafer flow patterns, complex process requirements, and to be difficult to be solved by a commercial solver. We propose an efficient mixed integer programming model that is based on the state evolution equation and token routing decision of a Petri net model of tool behavior rather than conventional models that find a Hamiltonian circuit.

■ TC59

H-Room 310, Third Floor

Tutorial: Assessing Solution Quality in Stochastic Programs via Sampling

Cluster: Tutorials

Invited Session

Chair: David Morton, Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States of America, morton@mail.utexas.edu

Co-Chair: Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu

1 - Assessing Solution Quality in Stochastic Programs via Sampling

David Morton, Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States of America, morton@mail.utexas.edu, Guzin Bayraksan

We present a simple, easily implemented procedure that uses Monte Carlo sampling to form a point and interval estimator on the optimality gap of a candidate solution to a stochastic program. We then discuss methods to reduce the computational effort, bias and variance of our simplest estimator. We also provide a framework that allows the use these optimality gap estimators in an algorithm by providing rules to sequentially increase the sample sizes and to terminate.

■ TC60

H-Room 311, Third Floor

Semidefinite Programming: Algorithms and Applications

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Bissan Ghaddar, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, bghaddar@uwaterloo.ca

1 - New Relaxations of the Quadratic Knapsack Problem Using Polynomial Programming
Bissan Ghaddar, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, bghaddar@uwaterloo.ca, Miguel Anjos, Juan Vera

Numerous problems in various applications can be expressed using polynomial equalities and inequalities. Polynomial programming, optimizing a polynomial objective function subject to polynomial constraints, is known to be NP-hard in the general case. In our research, we propose new relaxations for the quadratic knapsack optimization problem using polynomial programming. Comparisons based on bounds and computational time are presented.

2 - Strong MIP Formulations for the Unit Commitment Problem
James Ostrowski, University of Waterloo, Waterloo, ON, Canada jostrows@engmail.uwaterloo.ca

In this talk we will discuss the Unit Commitment (UC) problem, an important problem for energy production. We will discuss current mixed integer programming formulations for the UC as well as give a new set of inequalities that can strengthen the linear programming relaxation.

3 - Alternating Direction Augmented Lagrangian Methods for Semidefinite Programming
Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Donald Goldfarb, Wotao Yin

We present an alternating direction method, a two-splitting scheme, based on an augmented Lagrangian framework for solving Semidefinite programming (SDP) problems in standard form. A multiple-splitting algorithm is then proposed to handle SDPs with inequality constraints and positivity constraints directly without transforming them to the equality constraints. Numerical results for frequency assignment, maximum stable set and binary integer quadratic programming problems are presented.

4 - Enhancing RLT Relaxations for Polynomial Problems with a Class of v-Semidefinite Cuts
Evrim Dalkiran, PhD. Candidate, Grado Department of Industrial and Systems Engineering, Virginia Polytechnic Institute & State U, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, dalkiran@vt.edu, Jitamitra Desai, Hanif D. Sherali

We enhance RLT-based relaxations for polynomial programs with a class of v-semidefinite cuts that are derived by imposing positive semidefiniteness on (constraint-factor scaled) dyadic variable-product matrices. We explore various strategies for generating cuts, and exhibit their relative effectiveness for tightening relaxations and solving the underlying polynomial programs. Insights are provided to reveal classes of v-semidefinite cuts that significantly improve performance.

■ TC61

H-Room 312, Third Floor

Logistics/Warehousing

Contributed Session

Chair: Bin Dai, Student, Hong Kong University of Science and Technology, Department of Industrial Eng and Mgmt, A509, HKUST, Clear Water Bay, Kowloon, Hong Kong - ROC, dbbudstar@gmail.com

1 - Analyze Autonomous Vehicle Storage and Retrieval Systems by Semi-open Queing Networks
Xiao Cai, University of Louisville, 205 Nob Hill Ln 7, Louisville, KY, 40206, United States of America, x0cai001@louisville.edu

The autonomous vehicle storage and retrieval system (AVS/RS) is a relatively new automated warehouse material handling technology. There are few papers in the literature on performance evaluation of AVS/RS. In this paper, we model the AVS/RS as a semi-open queueing network (SOQN) and present an efficient, approximate algorithm to evaluate performance measures of this SOQN.

2 - Workforce Implications in Warehouses and Distribution Centers
Lourdes Medina, Graduate Student, The Pennsylvania State University, 202 Cunningham Hall, Weston Community Center, University Park, PA, 16802, United States of America, lam458@psu.edu, David Nembhard

This work investigates important aspects for the workforce of warehouses and distribution centers. A review of the literature is provided, defining eight relevant topics. The main focus is given to logistics publications. The evaluated concepts consist of: recruitment, retention, management coaching behavior, work environment, safety issues, training, company size and technology. Furthermore, critics are given and opportunities for future work are defined.

3 - A Study of ETV in Airport Cargo Terminal
Junjae Chae, Assistant Professor, Korea Aerospace University, 100 Hanggongdae-gil, Hwajeon-Dong, Keokyang-gu, Goyang, 412-791, Korea, Republic of, jchae@kau.ac.kr, Yoonseok Chang, Sanghyeon Kim, Moonsu Lee

ETV (Elevating Transfer Vehicles) system is similar to AS/RS but is different from AS/RS. It is used in airport cargo terminal for handling aircraft ULD containers in the multilevel mass storage system. Because the size of handling material and the mechanism for moving material are different, there is no insuring that the rule for operational efficiency for AS/RS is applicable to ETV system. This study tests the validity of the rules for AS/RS applied to ETV and find the applicable rule for ETV.

4 - Mathematical Modeling of the Colombian Sugar Cane Supply Chain
Carolina Saldaña, Universidad Externado de Colombia, Calle 12 1 17 Este, Bogota, Colombia, jenny.saldana@uexternado.edu.co, Carlos Osorio-Ramirez

In this paper a mixed integer programming model is presented in order to describe and analyze the colombian sugar cane supply chain.

5 - Sensor Placement for Implementing Ultrasonic Sensor Network
Bin Dai, Student, Hong Kong University of Science and Technology, Department of Industrial Eng and Mgmt, A509, HKUST, Clear Water Bay, Kowloon, Hong Kong - ROC, dbbudstar@gmail.com, Ka Shek Lee

Ultrasonic sensor network is promising for manufacturing and warehouse. One of the fundamental problems of implementing ultrasonic sensor network is the placement of ultrasonic sensors. In this study, a nonlinear program has been developed to study the 3-dimension sensor placement problem and sensor deployment strategy. Moreover, the performances of different deployment methods are evaluated by simulation and real experiments. Finally the guidelines of ultrasonic sensor placement are presented.

■ TC62

H-Room 313, Third Floor

Behavioral Operations Management

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, aovchinnikov@darden.virginia.edu

1 - Dual Sales Channel Management with a Buyback Contract
Murat Kaya, Assistant Professor, Sabanci University, Sabanci Universitesi MDB Fakultesi, Orhanli Tuzla, Istanbul, 34956, Turkey, mkaya@sabanciUniversityedu

We study how a manufacturer can use a buyback contract to manage dual sales channels: An online direct channel and an independent retail channel. The channels compete in service, where service is defined as the delivery lead time in the direct online channel and product availability in the retail channel. We compare the outcomes under wholesale price and buyback contracts in dual, direct-only and retail-only channels structures.

2 - Darden's Luckiest Student (DLS) High-Stakes Risk Experiment
Sam Bodily, Darden School Univ of VA, 100 Darden Boulevard, Charlottesville, VA, 22903, United States of America, bodilys@darden.virginia.edu, Phil Pfeifer

We report experiments wherein student attitude towards risk with 50/50 outcomes of $0 or a full-semester of tuition was elicited from two successive MBA classes. In the first class, students were first asked for certainty equivalents (CEs) to a hypothetical lottery and then later for a real lottery. In the later class, we studied the effect on risk attitude of a) buying versus selling price, b) seeing a video of a student getting zero the previous year and c) whether responses were made public.

3 - Revenue and Cost Management for Remanufactured Products
Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, aovchinnikov@darden.virginia.edu

We present a model of firm's remanufacturing operations and a behavioral study that estimates its key element - a function that describes the fraction of consumers who switch from new to refurbished product. Our behavioral study shows that this function has an inverted-U shape and hence cannot be modeled using the popular WTP-based approach. We solve the model for both the inverted-U and WTP-based behaviors and comment on how firm's policy changes.

■ TC63

H-Room 314, Third Floor

Resource Allocation in Health Care

Contributed Session

Chair: Alia Stanciu, Assistant Professor of Management, Bucknell University, 322 Taylor Hall, School of Management, Lewisburg, PA, 17837, United States of America, alia.stanciu@bucknell.edu

1 - Developing Federal Resource Allocation Strategies to Mitigate Cross-regional Pandemic Outbreaks
Alex Savachkin, Assistant Professor, University of South Florida, 4202 E. Fowler Ave, Tampa, FL, 33620, United States of America, savachki@eng.usf.edu, Tapas Das, Andres Uribe, Diana Prieto

We present a simulation based optimization methodology to develop strategies for deploying scarce federal resources during the spread of cross-regional pandemic outbreaks. The simulation includes a comprehensive characterization of virus epidemiology, social dynamics, and containment strategies. The simulation embeds a dynamic cost-based optimization model to generate federal mitigation strategies subsuming regional policies for vaccination, antiviral application, and social distancing.

2 - Estimating the Effect of Vaccination Policies for Smallpox Outbreak
Yingtao Ren, PhD Student, Daniel J. Epstein Department of Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089-0193, United States of America, yingtaor@usc.edu, Fernando Ordonez

To assist policymakers planning an efficient response, we propose a mathematical model to estimate the number of deaths using different vaccination strategies for a smallpox outbreak in a single city. Our results show that our model approximates well-published simulation models. Based on the model, we derived the threshold for deciding which strategy to implement to minimize the number of deaths. The simplicity of the model allows its use in a network model to plan for a nationwide response.

3 - Incentives for Multi-level Allocation of HIV Prevention Resources- A Game Theoretic Approach
Monali Malvankar, PhD Candidate, Ivey School of Business, University of Western Ontario, 1151 Richmond St North, London, ON, N6A3K7, Canada, mmalvankar@ivey.uwo.ca, Xinghao Yan, Greg Zaric

HIV prevention funds often traverse several levels of decision-making. Decision makers at each level use equity-based heuristics that may lead to sub-optimal allocation. We model the allocation process as a Stackelberg game in which an upper-level decision maker uses an incentive scheme based on preferences of the lower-level decision makers to encourage optimal allocation of prevention funds.

4 - Demand Management in Health Care: Protection Levels under Random Resource Requirements
Alia Stanciu, Assistant Professor of Management, Bucknell University, 322 Taylor Hall, School of Management, Lewisburg, PA, 17837, United States of America, alia.stanciu@bucknell.edu, Luis Vargas

We consider how to set protection levels in a service system with groups of customers, when the resource demands of the customers are random variables. This is particularly true in surgical units. We show how the calculation of the protection levels changes when one of the groups' demand always exceeds system capacity, and the relationship of the formulas in the random case to those in the traditional case of deterministic resource requirements.

■ TC64

H-Room 202A, Second Floor

Education I

Contributed Session

Chair: Nicola Petty, Senior Lecturer, University of Canterbury, Private Bag 4800, Christchurch, 8140, New Zealand, nicola.petty@canterbury.ac.nz

1 - Ideas for Improving LP in Introductory Textbooks to Improve Teaching
Shane Dye, Senior Lecturer, University of Canterbury, Private Bag 4800, Christchurch, 8140, New Zealand, shane.dye@canterbury.ac.nz, Nicola Petty

In this paper we introduce three complementary practices to improve the teaching of linear program models in spreadsheets to entry-level business students: "Explore, standardise and repeat". These are supported by the results of educational research, and the experience of teaching LP to entry-level business students for over twenty years. A number of popular textbooks are examined to see how well they fit with these ideas.

2 - An Innovative Approach to Teach the Risk Pooling Concept
Lindsey Scheggia, Shippensburg University, 1871 Old Main Drive, Shippensburg, PA, 17257, United States of America, ls7467@ship.edu, Robert Setaputra

Risk pooling is of great importance in the business field, especially in areas such as supply chain and operations management. Teaching the concept of risk pooling is fairly easy; yet providing practical examples proves a little more difficult. The objective of this paper is to research and provide several real life cases that would further a student's understanding of this concept.

3 - A Graphic Novel for Management Science Education
Robert Hampshire, Carnegie Mellon University, 4800 Forbes Ave, Pittsburgh, United States of America, hamp@cmu.edu

I will introduce a graphic novel series called Super Operations Manager. The graphic novel has been used in the classroom to further the learning of management science concepts. This talk will describe and evaluate the class room use of this graphic novel.

4 - Solving Two Stage Stochastic Programs in Excel
Tom Robbins, Assistant Professor, East Carolina University, College of Business, 3212 Bate Building, Greenville, NC, 27858, United States of America, robbinst@ecu.edu

Stochastic Program formulations are known to provide superior solutions to optimization problems with uncertain parameters. However, due to the difficulty in formulating and solving stochastic programs many researchers resort to solving the mean value approximation. In this talk we discuss the practicality of formulating and solving two stage stochastic programs in Excel using a new version of Frontline Systems Solver Add-In, Risk Solver Platform.

5 - Teaching Operations Research and Statisics with Videos on Youtube
Nicola Petty, Senior Lecturer, University of Canterbury, Private Bag 4800, Christchurch, 8140, New Zealand, nicola.petty@canterbury.ac.nz

Short video clips teach difficult concepts effectively. Students receive information through aural and visual channels and can pause or watch multiple times. Nicola Ward Petty has developed ten short amusing videos to teach aspects of Excel, linear programming, and inference. They are on www.youtube.com/ucmsci and have been viewed by thousands internationally. In this presentation she explains how these videos have been effective, and gives guidelines for developing such clips.

■ TC65

H-Room 202B, Second Floor

Inventory Management During Transition

Contributed Session

Chair: Suresh K Goyal, Professor, Concordia University, John Molson School of Business, Montreal, QC, H3G1M8, Canada, sgoyal@jmsb.concordia.ca

1 - End-of-life Inventory Decisions for Consumer Electronics Spare Parts
Morteza Pourakbar, Erasmus School of Economics, Erasmus University Rotterdam, BurgOudlaan 50, Rotterdam, 3000DR, Netherlands, pourakbar@ese.eur.nl, Rommert Dekker, Hans Frenk

We consider consumer electronics (CE) manufacturer problem of controlling the inventory of spare parts in the final phase. Pertinent research in the literature consider the repair of defective products as the only way to meet demand. But

considering the price erosion factor of CE products over time, we seek to build policies aiming at finding the optimal final order quantity and time to switch to an alternative replacement policy, such as swapping, during this phase of service life cycle.

2 - A Continuous-time Examination of the Last Buy Problem
Nicholas Leifker, Graduate Fellow, University of Iowa, Mgmt. Sci. Department, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, nicholas-leifker@uiowa.edu, Philip Jones, Timothy Lowe

The goal of the last buy problem is to find the optimal order amount for spare parts during the post-manufacture phase of a product's life. We assume an exponential lifetime distribution for both the assemblies and spare parts. We then determine continuous-time distributions for the rate of change of demand, and find time-discounted costs as a function of the order amount. We then find the optimal order amount by examining the rate of change of the cost as a function of order amount.

3 - Initiation of an Inventory Control System
Sven Axsater, Professor, Lund University, Box 118, Lund, 22100, Sweden, sven.axsater@iml.lth.se

This paper considers a single-echelon inventory system with a warehouse facing compound Poisson customer demand. The replenishment lead-time is constant. There are standard holding and backorder costs but no set-up or ordering cost. It is assumed that the demand process starts at a certain given time. We derive the optimal transient ordering policy under this assumption.

4 - A One-time Excess Inventory Disposal Decision under Stochastic and Price Dependent Demand
Xiaoyan Zhu, Assistant Professor, University of Tennessee, 307 East Stadium Hall, Knoxville, TN, 37996, United States of America, xzhu5@utk.edu, Sila Cetinkaya

We consider a periodic-review stochastic inventory system which will be switched to a new base-stock policy. Hence, excess on-hand inventory that exceeds the new order-up-to level must be disposed of. Focusing on the case where the demand during the disposal period is a price dependent random variable, we develop a general model maximizing the sum of expected disposal income and the expected discounted future revenues minus costs. Our goal is to compute the optimal disposal quantity.

5 - One-time Only Promotions for Multiple Products under Financial Constraints
Suresh K Goyal, Professor, Concordia University, John Molson School of Business, Montreal, QC, H3G1M8, Canada, sgoyal@jmsb.concordia.ca, Satyaveer Chauhan

In this paper we formulate the inventory problem of multiple products where one or more suppliers have offered limited term promotions. We suggest a solution approach for the buyer to take advantage of such an offer under financial constraints.

■ TC66

H-Room 204A, Second Floor

Production and Hedging in Supply Chains

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Sridhar Seshadri, Professor, University of Texas Austin, Department of IROM, Austin, United States of America, Sridhar.Seshadri@mccombs.utexas.edu

1 - Are Financial Markets Important for Your Supply Chain?
Nikolay Osadchiy, PhD Candidate, New York University, 44 West 4th St, New York, NY, 10012, nosadchi@stern.nyu.edu, Vishal Gaur, Sridhar Seshadri

We conduct empirical investigation of the correlation between demand and financial market returns in a supply chain setting. We find that this correlation is the lowest at the retailers' level and increases for upstream levels of a supply chain. We discuss the bullwhip effect, lead time, excess inventory, and manufacturing capacity as potential causal factors. Our results shed light on the sources of volatility in supply chains.

2 - Investments, Hedging, and Frictions
Kumar Muthuraman, Professor, McCombs School of Business, kumar@austin.utexas.edu

The objective of this paper is to analyze the interplay between operational (capacity expansion and production) and financial (dividends and financial hedging) decisions. We examine the effects of frictions in operational decisions (capacity expansion costs and capacity expansion delays) on firm's joint operational and financial policy. We consider a model that captures these interactions. Using optimal policies for this model we answer several questions that provide insights.

3 - A Constant-Q Heuristic for Spot and Forward Procurement
Burcu Tan, PhD Candidate, University of Texas at Austin, IROM, B6500, 1 University Station, Austin, TX, 78712, United States of America, Burcu.Tan@phd.mccombs.utexas.edu, Ganesh Janakiraman, Sridhar Seshadri

We analyze the effectiveness of a simple ordering heuristic for commodities procurement from spot and forward markets. The heuristic calls for ordering a fixed quantity from the forward market at each period generating a steady inflow and then making adjustments through the spot market. We build on Goel and Gutierrez (2006), which provides the optimal policy for spot and forward procurement in a framework that incorporates the marginal convenience yield.

■ TC67

H-Room 204B, Second Floor

Data Envelopment Analysis: Methods and Applications

Cluster: Data Envelopment Analysis
Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu

1 - Modeling Weak Disposability in Data Envelopment Analysis under Relaxed
Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi, Victor Podinovski

Treatment of undesirable outputs in DEA requires replacing the free disposability assumption by weak disposability. Kuosmanen (2004) technology is the correct convex technology exhibiting weak disposability. This paper relaxes the full convexity and considers: 1) output sets are convex, 2) no convexity is assumed. We first show that the Shephard technology is larger than necessary. We then develop the correct models for both cases and give an axiomatic definition of the Shephard technology.

2 - A Data Density Test for Non-parametric Production Sets
Ole Olesen, University of Virginia, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America ole@sam.sdu.dk, Jens Leth Hougaard, Mette Asmild

Maintaining a common inefficiency distribution a binomial test is proposed for over-representation of data in a convex cone within a DEA production possibility set. Volumes of slices of i) a convex hull estimator and ii) the intersection of this set with a "rational inefficiency cone" are estimated. The suggested approach is illustrated using a Monte Carlo simulation and an empirical example.

3 - Stochastic Production Frontier Analysis With Multiple Outputs: A Two-Stage Approach
John Ruggiero, John.Ruggiero@notes.udayton.edu, Andy Johnson, Trevor Collier

One of the disadvantages of the stochastic frontier model is the inability to measure inefficiency in the presence of multiple outputs without appealing to the cost side. DEA proponents cite the ability of DEA to handle multiple inputs and multiple outputs as a distinct advantage over the stochastic frontier models. We provide a two-stage multiple output stochastic frontier model that does not require input prices. We analyze the performance of the model using a Monte Carlo design.

■ TC68

H-Room 206, Second Floor

Stochastic Programming Models in Supply Chain Management

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Kai Huang, Assistant Professor, Binghamton University, School of Management, Binghamton University, Binghamton, NY, 13902, United States of America, huang@binghamton.edu

1 - Dynamic Fleet Scheduling with Uncertain Demand and Customer Flexibility

Jonathan Turner, PhD Student, Northewestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, JonathanTurner@u.northwestern.edu, Mark Daskin, Karen Smilowitz, Tito Homem-de-Mello, Soonhui Lee

Our dynamic fleet reduction model demonstrates how a carrier can improve fleet utilization by offering rebates to customers that accept alternate delivery times. The model makes decisions at stages as demand is revealed throughout an order horizon. It does so by sampling anticipated demand to avoid recourse penalties in later stages. The added value of incorporating stochasticity is affected by the customers' willingness to wait for delivery commitments and the order lead time distribution.

2 - Convex Approximations of a Multiperiod Probabilistically-Constrained Model with Random Disruptions

Tara Rengarajan, PhD Student, Operations Research Program, University of Texas at Austin, ETC Building, 204 East Dean Keeton St., Austin, TX, 78705, United States of America, tara_rengarajan@mail.utexas.edu, Nedialko Dimitrov, David Morton

We study a convex approximation of a multiperiod probabilistically-constrained program for hedging against random disruptions. We develop an optimal stratified sampling scheme subject to a computational budget, and show this can improve over naive sampling by an order of magnitude in the number of time periods provided the number of disruptions is small. We demonstrate the performance of our scheme on examples from inventory control.

3 - A Comparison Study of Cost Minimization and Reward Maximization Models in Assemble-To-Order Systems

Kai Huang, Assistant Professor, Binghamton University, School of Management, Binghamton University, Binghamton, NY, 13902, United States of America, huang@binghamton.edu, Ton de Kok

We continue to report on our progress on the study of stochastic programming models in ATO systems. In classical inventory theory, there are two types of objectives: cost measures and service measures, whose relationship has been extensively studied. However, in ATO systems, such a comparison study is missing. The recent progress on the stochastic programming models allow us to compare these models in an ATO system. Such a comparison study provides us insights that were not shown before.

4 - The p-Median Location Problem: A Counter-measure Policy to Mitigate Random Facility Disruptions

Qingwei Li, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, qli4@mail.usf.edu, Bo Zeng, Alex Savachkin

Facilities in the conventional p-median facility location problem fail in reality due to random disruptions such as natural hazards or man-made malignant acts. We extend the conventional p-median facility location problem by assuming that each facility fails with a different probability. We then develop a counter-measure investment strategy to improve reliability of individual facilities and conduct a sensitivity analysis on the total available investment budget.

■ TC69

H-Indigo A, Second Floor

Environmental Operations I

Contributed Session

Chair: Jing-Quan Li, Assistant Research Engineer, Calfornia PATH, UC Berkeley, Richmond, CA, 94804, United States of America, jingquan.li@gmail.com

1 - Modeling to Generate Alternatives in Waste Management Planning Using Simulation-optimization

Julian Scott Yeomans, York University, Schulich School of Business, OMIS, SSB 338, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, syeomans@schulich.yorku.ca

It has been shown in environmental policy formulation that it is preferable to create several good alternatives that provide very different approaches to a problem. This study shows how simulation-optimization can be used to generate multiple policy alternatives that satisfy required system criteria and yet are maximally different in decision space. The efficacy of this stochastic modelling-to-generate-alternatives approach is demonstrated on a waste management planning application.

2 - Modeling Integrated Crop-livestock Systems in Iowa

Guiping Hu, Iowa State University, 3033 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu

Sustainable agriculture is gaining popularity due to the increasing concern over environmental issues, including pollution and energy and natural resource conservation. In this study, we integrate the crop production and livestock systems for the purpose of reducing external inputs and maximizing nutrient recycing. With Linear programming methodology, we model this decision making problem quantitatively. Case studies and analyses are carried out with real field data.

3 - Managing Selective Catalytic Reduction for Coal-fired Power Plants

Passakorn Phananiramai, University of Texas at Arlington, Industrial & Manufacturing Systems Engr., Campus Box 19017, Arlington, TX, 76019-0017, United States of America, passakorn.phananiramai@mavs.uta.edu, Jay Rosenberger, Clint Carter, Don Harris, Victoria Chen, Seoung Bum Kim, Melanie Sattler, Sadegh Sadeghipour

Selective catalytic reduction (SCR) is an emission control technique that reduces harmful oxides of nitrogen (NOx) emissions. In this research, we develop an SCR management tool that finds an optimal SCR management plan which minimizes NOx emissions using mathematical optimization techniques. We demonstrate the effectiveness of the tool and provide a tradeoff between NOx reductions and operating costs using Pareto optimal efficient frontiers. Finally, we discuss topics of future research.

4 - The Energy Box: Locally Automated Optimal Control of Residential Electricity Usage

Daniel Livengood, PhD Candidate, Massachusetts Institute of Technology, 550 Memorial Drive, Apt 23B-3, Cambridge, MA, 02139, United States of America, dlivengo@mit.edu, Richard Larson

The Energy Box is proposed as a 24/7 service via a background processor operating on a local computer or remote location, silently managing one's home or small business electrical energy usage. It operates best in an environment of demand-sensitive real-time pricing. We assume that, in time, virtually every electrical device in a home or small business will be controllable from the Energy Box. The primary integrating method of optimization and control is stochastic dynamic programming.

5 - Sustainability Provisions in the Bus Scheduling Problem

Jing-Quan Li, California PATH, University of California-Berkeley, Richmond, CA, 94804, United States of America, jingquan@path.berkeley.edu, Larry Head

The traditional vehicle scheduling problem attempts to minimize vehicle capital and operating costs. However, the carbon footprint and toxic air pollutants have now become increasingly important to society. This paper studies the bus scheduling problem and evaluates new types of buses that use alternative energy sources to reduce emissions, including some toxic air pollutants and carbon dioxide.

Tuesday, 4:30pm - 6:00pm

■ TD01

C-Room 21, Upper Level

Portfolio Decision Analysis Panel Discussion

Sponsor: Decision Analysis
Sponsored Session

Chair: Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, TKK, 02015, Finland, ahti.salo@hut.fi

1 - Portfolio Decision Analysis Panel Discussion

Moderator: Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, 02015, Finland, ahtisalo@cc.hut.fi, Panelists: Jeff Keisler, Alec Morton

In this panel, leading researchers and practitioners discuss how portfolio decision analysis can be best harnessed in support of organizational decision making. Among other things, the panelists will consider preconditions for the successful deployment of methods, summarize 'lessons learned' from their professional experience and identify future research needs. The panelists include presenters such as David Matheson, Don N. Kleinmuntz, Carl Spetzler and Larry Phillips (to be confirmed).

■ TD02

C-Room 22, Upper Level

Decision Analysis Arcade I

Sponsor: Decision Analysis
Sponsored Session

Chair: Yael Grushka-Cockayne, University of Virginia, 100 Darden Blvd., Charlottesville, VA 22903, United States of America, ygrushka.phd2003@london.edu

1 - Detecting Credit Card Fraud with Hybrid Influence Diagrams
Barry Cobb, Associate Professor, Department of Economics and Business, Virginia Military Institute, Lexington, VA, United States of America, cobbbr@vmi.edu

An influence diagram model can be used to detect online credit card transactions that may be fraudulent. By creating decision rules based on merchandise value and additional address and product characteristics, the model can be used to develop policies that help businesses decide when to investigate an order's legitimacy.

2 - Diversifying Ambiguity: How Individuals Evaluate Multiple Uncertain Prospects
Dolchai La-ornual, Ph.D. Student, INSEAD, Boulevard de Constance, Fontainebleau Cedex, 77305, France, dolchai.la-ornual@insead.edu

We examine whether individuals perceive benefits from diversification when prospects are ambiguous and how those benefits compare to analogous situations under risk. Results from a series of experiments suggest that individuals derive less benefit from diversification under ambiguity than under risk. However, people seem to diversify to a greater extent when prospects are ambiguous. This may be due to adjustments of exposure to aleatory uncertainty in presence of epistemic uncertainty.

3 - Accuracy of Entropy Approximations for Multivariate Discrete Distributions
Luis Montiel, PhD Student, The University of Texas, 1 University Stateion, C2200, Austin, TX, 78712, United States of America, LVM92@mail.utexas.edu, J. Eric Bickel

Assessing joint probability distributions is often difficult, requiring many heavily conditioned assessments. To simplify the process, decision analysts frequently use maximum entropy approximations. How good are these approximations in the face of limited information? In this talk, we will explore the behavior of entropy approximations for multivariate discrete distributions, in which the variables are not necessary binary, and the relation to the correlation structure of the distribution.

■ TD03

C-Room 23A, Upper Level

Multi-objective Problems in Medicine

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Vira Chankong, Associate Professor, Case Western Reserve University, Electrical Engineering and Computer Scie, 10900 Euclid Avenue, Olin 708, Cleveland, OH, 44106, United States of America, vira@case.edu

1 - Challenges in Applying Compressive Sampling to MR Imaging
Nicole Seiberlich, Research Associate, Case Western Reserve University, 11100 Euclid Ave, MRI Research - Bolwell B121, Cleveland, OH, 44106, United States of America, nicole.seiberlich@case.edu, Mark Griswold

MRI is a leading medical imaging modality. MRIs primary drawbacks are limited sensitivity and speed. Compressed sensing (CS) has the potential to greatly improve both of these areas. However, many issues limit the applicability of CS to MRI. Here we will discuss some of these limitations and some of the early attempts and why some of them have failed. In particular we will focus on real-life examples of how MRI data is sampled and how this relates to the theory of compressive sampling.

2 - Conformal Avoidance – The Multi-objective Treatment Planning Paradigm for Cancer Radiation Therapy
Q Jackie Wu, Associate Professor, Duke University Medical Center, Department of Radiation Oncology, 3295 DUMC, Durham, NC, 27710, United States of America, jackie.wu@duke.edu

Since the radiation kills living cells along its pathway, the goal of caner radiation treatment is to focus the radiation to cancers and avoid the radiation damage to neighboring critical organs and normal tissues. The planning has to consider different organs responses to radiation intensity and volume and prescription target radiation, a multi-objective paradigm in daily clinical practice.

3 - Three Competing Objectives in Diagnostic and Therapeutic Medicine
Vira Chankong, Associate Professor, Case Western Reserve University, Electrical Engineering and Computer Scie, 10900 Euclid Avenue, Olin 708, Cleveland, OH, 44106, United States of America, vira@case.edu

Speed, effectiveness and low side effects are three common competing objectives in diagnostic and therapeutic medicine. This talk will attempt to highlight the multi-objective nature of diagnostic and treatment planning problems in compressive sensing for medical imaging, Intensity Modulated Radiation Therapy and Arc Radiation Therapy and to explore approaches to assist healthcare providers to make the best-compromised decisions.

■ TD04

C-Room 23B, Upper Level

Data Mining Applications

Sponsor: Data Mining
Sponsored Session

Chair: Rong Duan, Principle Member of Tech Staff, AT&T, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com

1 - Classifying Services by Customer Specified Performance Dimensions
Venkat Venkateswaran, Clinical Associate Professor, RPI Hartford, Room 725, 275 Windsor Street, Hartford, CT, 06120, United States of America, venkav3@rpi.edu, John Maleyeff

We study a classification method where services are grouped by dimensions of performance important to customers rather than commonality of process characteristics. A sample of 165 services were rated (0/1) on 9 dimensions important to customers. The resulting binary vectors were then grouped into 8 sets using a binary vector clustering procedure. The sets produced are quite different from what would result from traditional schemes. Implications for service innovation and staffing are discussed.

2 - Anomaly Detection with Real-time Contrasts
Houtao Deng, PhD student, Department of Industrial, Systems and Operations Engineering, Arizona State University, Tempe, AZ, 85287-5906, United States of America, hdeng3@asu.edu, George Runger

System monitors to detect anomalies in high-dimensional data streams are important for many applications. Previous work transformed the problem to supervised learning so that robust machine learning tools could be applied. A more computational method is used here to transform the problem and compared to previous results.

3 - Manipulation Robustness of Collaborative Filtering Systems
Xiang Yan, Stanford University, Packard 274, Stanford, CA, United States of America, robbie.yan@cs.stanford.edu, Benjamin Van Roy

Collaborative filtering systems, which recommend to users products that similar users like, have become targets of manipulation by unscrupulous vendors. We provide theoretical and empirical results demonstrating that while common nearest neighbor algorithms, which are widely used in commercial systems, can be highly susceptible to manipulation, two classes of collaborative filtering algorithms which we refer to as linear and asymptotically linear are relatively robust.

4 - Sentiment Analysis of Stocks Based on News Articles
Ronen Feldman, Professor, Hebrew University, School of Business Admin., Jerusalem, Israel, ronen.feldman@huji.ac.il

We present CARE - a brand new hybrid Machine Learning/Knowledge Engineering-based system for extracting complex relations from free natural language text. We then show two applications that utilize CARE. The first application extracts business events out of news articles and serves as a foundation for an alert mechanism for investors. The second application scores each of the S&P 500 stocks according to the positive/negative sentiment that appears in news articles that are related to it.

■ TD05

C-Room 23C, Upper Level

Joint Session QSR/ HAS: Defining the Science of Quality in Public Health

Sponsor: Quality, Statistics and Reliability & Health Applications Sponsored Session

Chair: John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

1 - What Does Quality Mean in Public Health

F. Douglas Scutchfield, Peter P Bosomworth Professor of, University of Kentucky, 121 Washington Ave, Lexington, KY, 40536-0003, scutch@email.uky.edu

Public Health , with roots in providing clean water and sanitary living conditions, has evolved into a complex entity with responsibilities as diverse as purchasing 75% of the vaccines purchased in America, auditing health care facilities for safety, establishing heath policies on issues such as obesity and smoking : all the while working in a political framework. The challenges of identifying what quality in public health is and how the OR community can develop measures will be discussed

2 - Challenges in 'Scoring' Health Care Quality: Perspective From the Joint Commission

Ann Watt, Associate Director, Division of Quality Measurement and Research, Joint Commission, One Renaissance Blvd, Oakbrook Terrace, Il, 60181, United States of America, awatt@jointcommission.org

The Joint Commission is responsible for assessing and certifying the quality of American hospitals and some ambulatory care centers. How these measures are selected and what challenges are present for the OR community to improving quality of care will be discussed

3 - Operational Challenges of the Vaccines for Children Program

Nancy Fasano, Director, CDC VAccinnes for Children Program, NAF5@CDC.GOV

The Vaccines for Children Program is a $3 billion federal entitlement program administered by the CDC that provides vaccines for eligible children according to the authorizing legislation, and reporting each year to the Office of Management and Budget. Discussed will be the challenges of balancing efficiency with convenience, accountability with flexibility, Local vs centralized control and resource allocation under public health mandates. What could be the role of Operational Science?

4 - Baldridge Here We Come:Challenges in Identifying Quality Measures in Public Health

Nick Macchione, Director, San Diego County Health and Human Services, Nick.Macchione@sdcounty.ca.gov

Public Health is now a complex operation in which good ideas without public support are bad ideas. Presented will be an outline of a model of public health with challenges to the OR/MS community to help in developing quality measures: Baldridge-here we come.

■ TD06

C-Room 24A, Upper Level

Prognostics/Health Management, Sensors, and RFID I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Abe Zeid, Northeastern University, College of Engineering, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zeid@coe.neu.edu

Co-Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

1 - RFID-enabled Process Visualization and Analysis in Ambulatory Care

Yi-Chin Lin, Carnegie Mellon University, 515 S Aiken Ave Apt 503, Pittsburgh, PA, 15232, United States of America, yichinl@andrew.cmu.edu, Rema Padman, Kai Zheng

We analyze patient throughput and process visibility for care delivery processes using time and location stamped data collected from RFID tags worn by patients, clinicians, and staff. We identify generalizable best practices using process visualization, pattern analysis, and simulation tools in an outpatient practice.

2 - Multiple Objective Optimization of Performance Based Logistics

Delia Villanueva, MS student, Industrial Engineering Department. The University of Texas at El Paso, 500 W. University Av., El Paso, TX, 79968-0521, United States of America, dvillanueva3@miners.utep.edu, Olivia Moreno, Heidi Taboada

A new Performance Based Logistics (PBL) optimization model is presented. PBL is one of the newest support strategy of the Department of Defense to improve the weapon system readiness. This work introduces a new multiple objective evolutionary approach that simultaneously optimizes objectives such as reliability, maintainability, and supportability. These objectives are based on procurement, operation, and maintenance components of the total cost of ownership.

3 - Effective Real Time Maintenance Management

Hatice Ucar, Research Assistant, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, hucar@wayne.edu, Ratna Babu Chinnam, Alper Murat

Manufacturing plants, in particular demanding facilities such as automotive body shops, have many stations with different maintenance requirements. Unless the stations are well maintained they will have increasing failure rates, which degrades throughput by time. Our real-time decision support system helps avoid production losses by guiding maintenance supervisor prioritize repair of simultaneously failed stations and schedule preventive maintenance depending on stations' remaining useful life.

4 - Optimal EPQ and Preventive Maintenance Plan under SPC

Yarlin Kuo, Professor, Yunlin University of Science and Technology, 123 University Road, Touliu Yunlin, Taiwan - ROC, kuoyl@yuntech.edu.tw, Syu-Jheng Syu

This paper finds the optimal EPQ and the optimal preventive maintenance plan of a failure prone production system under the EPQ and SPC setting. Assume that the unobservable machine failure causes the process to shift to out-of-control. Expression of average cost per unit time is derived based on renewal reward theorem. Nnumerical studies indicate that more efficient maintenance practice is more effective in reducing average cost then the reduction in production setup cost.

■ TD07

C-Room 24B, Upper Level

Design and Analysis of Experiments in Modern-day Science and Technology

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Tirthankar Dasgupta, Harvard University, Science Center, Dept of Statistics, 1, Oxford St, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu

1 - Multi-Objective Optimal Experimental Designs in Event-Related fMRI Studies

Abhyuday Mandal, University of Georgia, Athens, GA, 30602-7952, United States of America, amandal@stat.uga.edu, Dibyen Majumdar, John Stufken, Ming-Hung Kao

Obtaining efficient designs for event-related functional magnetic resonance imaging (ER-fMRI) is arduous. Kao et al. (2009) proposed an efficient approach for finding good ER-fMRI designs. As other methods known hitherto, our approach fails to take into account the link between estimation of the HRF and detection of active brain voxels. Here we consider a nonlinear model to accommodate both goals in a unified setting, define design criteria to evaluate designs and search optimal designs.

2 - Efficient Data Collection Methods for Modern Meta-Analysis

Peter Qian, Assistant Professor, University of Wisconsin-Madison, 1300 University Ave, Department of Statistics, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

Meta-analysis is becoming increasingly popular in many modern scientific and engineering fields. Examples include emulation based on a host of similar computer models in geosciences and statistical integration of genomic data from multiple sources. This talk reports some recent advances in experimental design methods for meta-analysis.

3 - Fast Calibration of Complex Computer Models

Derek Bingham, Professor, Simon Fraser University, 8888 University Ave, Burnaby, BC, Canada, dbingham@stat.sfu.ca, Stephan Sain, Matt Pratola

Our work arises from a study of parameters that governs the behavior of electron storms in the upper atmosphere that presents challenges that make the standard model calibration methods problematic. The first is the large output data structure and the second is that the process response surface is not well represented by a stationary covariance. We propose new methodology for the design and analysis of calibration experiments that is effective in this setting.

4 - Proposal of "Multi-Sigma" to Optimize a Complex System with Many Inputs and Trade-off Outputs

Kotaro Kawajiri, Researcher, National Institute of Advanced Industrial Science and Technology, 16-1 Onogawa, Tsukuba, Japan, kotaro-kawajiri@aist.go.jp

Nowadays, a system of manufacturing becomes large and complex with many inputs and trade-off outputs. A novel scheme "Mlti-Sigma"is proposed to optimize such a complex system easily by design of experiment and genetic algorithm. Experiments are conducted and the results are analyzed statistically by design of experiment. Outputs are optimized by genetic algorism using regression formula obtained by statistic analysis. The effect of the scheme is verified by some case studies in this study.

■ TD08

C-Room 24C, Upper Level

Data Mining Contest

Sponsor: Data Mining
Sponsored Session

Chair: Claudia Perlich, Research Staff, IBM T.J. Watson Research Center, P. O. Box 218, Yorktown Heights, NY, 10598, United States of America, perlich@us.ibm.com

1 - INFORMS Data Mining Contest

Claudia Perlich, Research Staff, IBM T.J. Watson Research Center, P. O. Box 218, Yorktown Heights, NY, 10598, United States of America, perlich@us.ibm.com

We will present the results of the second annual INFORMS data mining contest (http://www.informsdmcontest2009.org/). The two tasks for this year's contest are: 1) modeling of a patient transfer guideline for patients with a severe medical condition from a community hospital setting to tertiary hospital provider and 2) assessment of the severity/risk of death of a patient's condition. For further information and motivation on the healthcare objectives see the background.

■ TD09

C-Room 25A, Upper Level

Scheduling Issues in Computer Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Adam Wierman, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, adamw@caltech.edu

1 - Scheduling to Balance Energy and Delay

Adam Wierman, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, adamw@caltech.edu

Energy usage of computer communications systems has quickly become a vital design consideration. One effective method for reducing energy consumption is dynamic speed scaling, which adapts the processing speed to the current workload. This work studies how to optimally scale speed to balance mean delay and mean energy consumption and how this speed scaling interacts with scheduling policy used.

2 - Queuing and Scheduling for Information Delivery

Tara Javidi, UCSD, 9500 Gilman Dr., La Jolla, CA, 92093, United States of America, tara@ece.ucsd.edu

Historically, the design of data networks has benefited from advances in queuing theory. The drive to achieve maximum efficiency in the networks, however, requires novel generalizations of classical queuing problems. The generalizations are due to the extension of the scheduling functionality across many layers, manipulating the information theoretic structure of data packets. In this talk, we will review some interesting examples of this interplay between information and queuing theories.

3 - Optimal Job Fragmentation on an Unreliable Server

Jayakrishnan Nair, Graduate student, California Institute of Technology, 1200 E California Blvd, MC 256-80, Pasadena, CA, 91125, United States of America, ujk@caltech.edu, Steven Low

Consider a server that alternates between states of availability and unavailability as per a semi-Markov process. When the server becomes unavailable, the job being processed needs to be restarted. For this system, we consider the problem of optimal job fragmentation so as to minimize the expected processing time T. It been proved recently that without fragmentation, T can be heavy-tailed even when the job size distribution is light-tailed. We show that fragmentation can alleviate this problem.

■ TD10

C-Room 25B, Upper Level

Stochastic Inventory and Related Models

Sponsor: Applied Probability
Sponsored Session

Chair: Marty Reiman, Alcatel-Lucent Bell Labs, 600 Mountain Ave., Murray Hill, NJ, United States of America, marty@research.bell-labs.com

1 - Hospital Capacity Effects on Inbound Ambulance Traffic

Paul Enders, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, penders@cmu.edu, Alan Scheller-Wolf, Soo-Haeng Cho, Masha Shunko

Emergency Department (ED) demand originates from two sources: walk-ins and ambulances. Demand for ED services regularly, but temporarily, exceeds supply. During these periods of crowding, adequate care still needs to be provided. The ability to provide care during periods of peak demand depends on the capacities of the ED, the underlying hospital, and nearby EDs. We investigate when, and whereto, ambulances should be diverted to surrounding EDs in case of a supply-demand mismatch.

2 - Global Dual Sourcing: Tailored Base Surge Allocation to Near and Offshore Production

Jan Van Mieghem, Professor, Kellogg-Northwestern University, MEDS dept, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, vanmieghem@kellogg.northwestern.edu, Gad Allon

We analyze a tailored base-surge (TBS) sourcing policy that replenishes at a constant rate from the offshore source and produces at the near shore plant only when inventory is below a target. We present performance bounds on the optimal cost and prove that economic optimization brings the system in heavy traffic. We determine the allocation of random demand into base and surge capacity, estimate corresponding working capital requirements, and identify and value the key drivers of dual sourcing.

3 - Replenishment and Redistribution in Supply Networks

David Yao, Professor, Columbia University, IEOR Dept, New York, NY, United States of America, yao@columbia.edu

We demonstrate that two decisions in a wide range of supply networks, the initial replenishment quantities and the in-period redistribution necessitated by supply-demand imbalance, contribute to the overall value function in qualitatively different ways, with a separation of scales: the contribution of the former is in the order of the demand rate; whereas that of the latter is in the lesser, square-root order of the demand rate. (Joint work with Yongbo Xiao, Tsinghua University.)

4 - Applying the Newsvendor Network Model to Assemble-to-Order Inventory Problems

Qiong Wang, Bell Labs, Alcatel-Lucent, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, qwang@research.bell-labs.com, Marty Reiman

The Newsvendor Network (NN) Model is a special stochastic program that applies to a two-stage production planning problem. The Assemble-to-Order (ATO) inventory model is a multi-period system that is known to be hard to optimally control. We introduce a variation of the NN model that is asymptotically equivalent to the original version and discuss the use of its optimal solution in the development of inventory policies in some ATO systems.

■ TD11

C-Room 25C, Upper Level

Queueing Models-Session

Cluster: Queueing Models
Invited Session

Chair: Robert Hampshire, Carnegie Mellon University, 4800 Forbes Ave, Pittsburgh, United States of America, hamp@cmu.edu

1 - A Queueing Model for Parking-induced Cruising Behavior

Katsunobu Sasanuma, PhD Student, Heinz College, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, katsasa@gmail.com, Richard Larson

We analyze parking-induced cruising behavior quantitatively using a queueing model with reneging. We investigate the stationary distribution of the system and present closed-form asymptotic expressions for some performance indices that capture the level of cruising traffic. We empirically evaluate these indices to reveal the seriousness of cruising congestion.

2 - A Spatial Queueing Model of a Large-scale Bike Sharing Program
Robert Hampshire, Carnegie Mellon University, 4800 Forbes Ave, Pittsburgh, United States of America, hamp@cmu.edu

We develop a spatial queueing model for large scale bike/car sharing services. Our motivating example is the Velib biking sharing program in Paris, which has 20,000 bikes and 1500 bike stations. Over 50 million trips have been taken on Velib bikes since its inception in 2007. Finally, we compare our approximate model to data from the Velib system.

3 - Priority Scheduling for Weighted Processor Sharing Queues
William Massey, Princeton University, Princeton, NJ, 08544, United States of America, wmassey@Princeton.EDU, Robert Hampshire

Through asymptotic scaling we can derive fluid and diffusion approximations for a weighted processor sharing queue. An analysis of the fluid model suggests a profit optimal scheduling policy for this system with the constraint that each customer class has access to the processor a given percentage of the time. We can show how this generalizes the c-mu rule.

4 - Admission and Termination Control of a Two Class Loss System
Mehmet Yasin Ulukus, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, myu1@pitt.edu, Refik Gullu, Lerzan Ormeci

We consider admission-termination control policies in a Markovian loss system with two classes, each with a fixed reward and termination cost, an arrival and service rate. An arriving job is either directly admitted or rejected, or admitted by terminating a current job. Given there is an idle server, termination is shown to be a nonoptimal decision. We establish the optimality of threshold-structured policies and identify conditions that ensure whether a class is preferred or strongly-preferred.

■ TD12

C-Room 26A, Upper Level

Locational Analysis and Computing

Sponsor: Computing Society
Sponsored Session

Chair: Tingting Cui, PhD Candidate, University of California Berkeley, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States of America, tingting@ieor.berkeley.edu

1 - Reliable Facility Location under Correlated Disruptions: A Continuum Approximation Approach
Xiaopeng Li, University of Illinois at Urbana-Champaign, 205 North Mathews Ave, B156, Urbana, IL, 61801-2352, United States of America, li28@uiuc.edu, Yanfeng Ouyang

This paper proposes a continuum approximation (CA) model to minimize the expected cost of the reliable uncapacitated fixed charge location problem where facilities are subject to spatially correlated disruptions. The paper presents ways to formulate the correlation among adjacent facility disruptions. Numerical experiments illustrate how the correlations significantly influence the optimal system design.

2 - Approximating the Hub Location Problem
Dongdong Ge, Stanford University, 14 Comstock Cir, Apt 106, Stanford, 94305, United States of America, dongdong@gmail.com, Yinyu Ye, Jiawei Zhang

This work discusses the approximation of the hub location problem(HLP). The work includes 3 parts. First, we investigate the hardness of the HLP and provide the in-approximation. Second, we provide the first constant approximation algorithm for the metric HLP and the first non-trivial approximation algorithm for the general case. Finally the computational results with the implementation of different randomized algorithms are analyzed.

3 - Optimization Models for Processing GPS Probe Vehicle Data
Ryan Herring, Ph.D. Candidate, University of California, Berkeley, 2105 Bancroft Way Suite 300, Berkeley, CA, 94720, United States of America, ryanherring@berkeley.edu, Alex Bayen

The number of GPS-enabled cell phones is increasing exponentially providing an abundance of traffic data. We present optimization models for processing this data for providing travel time estimates. In particular, we introduce Mobile Millennium, a pilot project for processing GPS and other data sources into real-time and forecasted traffic conditions.

4 - Two-Stage Facility Location Problem with Second-Stage Activation Costs
Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com, John Penuel

We study a stochastic facility location problem where facilities must first be located, then activated before they can satisfy scenario demands. Fixed charges arise in the location of the facilities, and then in their activation. Hence, integer variables are present in both stages of the problem. We derive cutting planes by solving a series of specialized shortest path problems based on a modified residual graph from the recourse solution.

■ TD13

C-Room 26B, Upper Level

Optimization in Practice VI - Health Care

Sponsor: Computing Society
Sponsored Session

Chair: Don Kleinmuntz, Executive Vice President, Strata Decision Technology LLC, 2001 S First St., STE 200, Champaign, IL, 61820, United States of America, dnk@strata-decision.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Implementing Enterprise-wide Capital Resource Optimization in Hospitals and Health Systems
Don Kleinmuntz, Executive Vice President, Strata Decision Technology LLC, 2001 S First St., STE 200, Champaign, IL, 61820, United States of America, dnk@strata-decision.com

Most U.S. hospitals and healthcare systems are mission-focused organizations that balance service quantity and quality against financial needs. This presentation will describe a multi-criteria decision analytic model for optimal capital allocation that has been implemented in hundreds of hospitals. The discussion will emphasize implementation challenges in these organizations.

2 - Optimization in the Scheduling of Breast Cancer Treatments
Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

In many cases, the diagnosis and/or treatment of breast cancer patients are in multi-step procedures with strict time constraints. For example, the chemotherapy is delivered in a sequence of treatments over a period of time. The optimization in the scheduling of breast cancer treatments is part of a comprehensive treatment management system with effectiveness and efficiency as its goals. To the least, it improves patients' waiting times and healthcare resource usages.

3 - A Software Suite for Public Health, Disaster Medicine and Emergency Response
Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu, Chien-Hung Chen

RealOpt© is a software enterprise system developed by Lee and her research team. It consists of decision support capabilities for modeling and optimizing the public health infrastructure for all hazard emergency response. It has been used in biological or radiological terrorism preparedness, infectious disease outbreaks planning, and natural disasters response. We will describe the various decision support modules, their designs and practical usage. This work is joint with CDC.

■ TD14

C-Room 27A, Upper Level

Genome Variation Analysis

Sponsor: Computing Society
Sponsored Session

Chair: Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu

1 - Estimating Local Ancestries From Genetic Information
Bogdan Pasaniuc, International Computer Science Insititute, 1947 Center St., Berkeley, CA, 94704, United States of America, bogdan@ICSI.Berkeley.EDU

Accurate inference of the ancestry at each location in the genome of complex human populations (e.g. African-Americans) based on genetic information is a challenging task. In this talk I am going to present accurate and computationally efficient methods for addressing this problem. The relationship between the genetic background of the studied populations and the quality of the local ancestries will also be discussed.

2 - New Approaches to the Decoding of Hidden Markov Models
Dan Brown, Associate Professor, University of Waterloo, David R. Cheriton School of Business, 200 University Ave. W., Waterloo, ON, N2L 3G1, Canada, browndg@uwaterloo.ca

Hidden Markov models are used in a many bioinformatics applications to divide discrete sequences into important features. The common Viterbi algorithm for HMM decoding is used to find the global explanation of maximum likelihood, which may be of low probability and incorrect. We focus on the idea of an HMM dividing a sequence into intervals and develop two alternative methods: one

which seeks a high probability cluster of similar explanations, and another summarizing the k most likely paths.

3 - Reconstruction of Parental Genotype From Microsatellite Data
Saad Sheikh, Department of Computer Science, University of Illinois at Chicago, 851 S Morgan St, (M/C 152), Chicago, IL, 60607, United States of America, ssheik3@uic.edu, W. Art Chaovalitwongse, Tanya Berger-Wolf, Isabel Caballero, Ashfaq Khokhar, Mary Ashley, Chun-An Chou, Bhaskar DasGupta

Kinship Analysis from microsatellite markers is an important area of population genetics with applications in conservation biology, kin selection, evolutionary biology and agriculture. We will discuss the combinatorial problem of reconstructing minimum parents necessary to explain a given cohort of individuals. We will present an Integer Linear Programming solution to the problem and discuss how the problem is related with other problems in kinship analysis and complexity theory.

4 - Applications of Phylogenetic Tree Inference at Genomic Scales
Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu, Guy Blelloch, R. Ravi, Ming-Chi Tsai

This talk will present work on using phylogenetic tree inferences across many local regions of a genome to study evolution from the molecular to the population level. We will first review some prior methods that have made phylogenetics at genomic scales practically possible. We will then see how the resulting genome-scale phylogeny data sets can help us solve important problems in population genetics, such as population substructure analysis and genotype/phenotype association testing.

■ TD15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Lyzasoft, Inc. - Prep Your Data with Lyza – Get into the Heart of Your Modeling Faster
Brian Krasovec, Founder & CTO, Lyzasoft, Inc., 1675 Broadway, Suite 1300, Denver, CO, 80202, United States of America

If you are frustrated by the tedious task of data preparation or hoping to get your students into heart of their modeling more quickly - Lyza is for you. Come learn how our self service approach will dramatically reduce the time it takes for you to profile, integrate, transform, and cleanse your data.

2 - Syncopation Software - DPL: Powerful Decision Analytics
Chris Dalton, CEO, Syncopation Software, Inc., 1623 Main Street, Concord, MA, 01742, United States of America, cdalton@syncopation.com

Learn about the powerful features in DPL! See how you can glean more insights with the Initial Decision Alternatives Tornado and Option Value Diagram. Save time in the pre-presentation crunch with the new endpoint replay capability. Go beyond project-level analysis by analyzing a portfolio of opportunities.

■ TD16

C-Room 28A, Upper Level

Contracts and Sourcing

Sponsor: Information Systems
Sponsored Session

Chair: Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu

1 - Flexibility, Rent Seeking and Control Rights in Contracting
Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu

We examine the role of hazard equilibration and rent seeking in contract design. The design of control rights in contracts could prevent parties from exploit contract incompleteness to appropriate rents. Further, outside options of parties strengthen incentives for specific investments, and thereby solves the holdup problem.

2 - Contract Flexibility and Negotiator Incentives
Eric Walden, Associate Professor, Texas Tech University, 19th Street, Lubbock, TX, 79409, United States of America, eric@ericwalden.net, Tridas Mukhopadhyay

IT outsourcing contracts are plagued by inflexibility. Using tournament theory we develop an economic model to explain how the contract negotiator's incentives influence contract flexibility. We show that neither wage nor commission gives any preference for flexibility. However, a promotion incentive does give the negotiator a preference for less flexible contracts. The preference for less flexible contracts is increasing in discount rate and in the number of competitors for the promotion.

3 - Global Multisourcing Strategy: What IT Services Research Can Learn From Manufacturing
Natalia Levina, Associate Professor, NYU, Kaufman Management Center, 44 West 4th Street, Room 8-78, New York, NY, 10012, United States of America, nlevina@stern.nyu.edu, Ning Su

"Multisourcing" is an emerging strategy in global IT services outsourcing. A central component of this strategy is combining services from multiple vendors to achieve optimal business outcome. A similar concept, supply base management, has been extensively examined by operations management scholars in the context of manufacturing. Here we examine the research on manufacturing to provide insights into tradeoffs involved in the use of multiple vendors in IT services multisourcing.

■ TD17

C-Room 28B, Upper Level

Security Challenges in e-Business Environment

Sponsor: e-Business
Sponsored Session

Chair: Byung Cho Kim, Assistant Professor, Virginia Tech, Business Information Technology, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu

1 - Internet Security: A Comparative Analysis of Liability Policy
Terrence August, Assistant Professor, UCSD, Rady School of Management, 9500 Gilman Drive, MC 0553, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu, Tunay Tunca

We study the effectiveness of vendor software security liability mechanisms under network externalities. We compare mechanisms that require a vendor to partially reimburse either users who incur patching costs or those who incur losses from security attacks, some of which are unpatchable zero-day events. We analyze these proposed liability schemes holding the security level of a software product fixed and then extend analysis to permit security investment by the vendor in response to liability.

2 - Vendor Information Risk Rating
M. Eric Johnson, Professor, Dartmouth College, Tuck School of Business, 100 Tuck Hall, Hanover, NH, 03755, United States of America, M.Eric.Johnson@tuck.dartmouth.edu, Zach Zhou

Vendors represent an important source of information risk. Recently there have been several industry led initiatives to create vendor risk ratings. Using a vertical differentiation framework, we model the impact of such ratings on vendor competition.

3 - Security vs. Convenience? An Experimental Study of User Misperceptions of Wireless Internet Service
Byung Cho Kim, Assistant Professor, Virginia Tech, Business Information Technology, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu, Yong-Wan Park

This study demonstrates that consumers make incorrect inferences about the relationship between security and convenience. We conduct three experiments to examine user perceptions of wireless Internet service quality. Our results indicate that users believe in improving security in return for losing convenience, although advanced technology can achieve both.

4 - Risk Management Issues in E-Business
Soumyo Moitra, Senior MTS, CERT/SEI, Carnegie Mellon, 4500 Forbes Ave, Pittsburgh, PA, 15213, United States of America, sdmoitra@hotmail.com

This paper discusses issues in risk management for e-business. It develops a model for costs and benefits of e-operations given the risk of Internet crime. The optimal balance lies in having enough security measures to reassure customers and business partners while at the same time not make the security system too onerous for users.

■ TD18

C-Room 28C, Upper Level

Wireless Networks 1

Sponsor: Telecommunications
Sponsored Session

Chair: Timothy Matis, Texas Tech University, Department of Industrial Engineering, Box 43061, Lubbock, TX, 79409, United States of America, timothy.matis@ttu.edu

1 - Epidemic-based Information Dissemination in Wireless Mobile Sensor Networks

Natarajan Gautam, Texas A&M University, 3131 TAMU, 235A Zachry, College Station, TX, 77843, United States of America, gautam@tamu.edu, Young Myoung Ko

We consider wireless mobile sensor networks under extreme environments. The limitation on computational power and energy of nodes forces us to consider explicit stopping criteria for information spread. The objective of this paper is to characterize the dynamics of the information spread and obtain performance measures based on stochastic modeling. We start with modeling information flow using a Markov chain and then relax the inter-transmission time distribution.

2 - Optimal Resource Replication in Query-Based Wireless Sensor Networks

Jeffrey Kharoufeh, Associate Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, jkharouf@pitt.edu, Guvenc Degirmenci

We develop and analyze a queueing model to evaluate resource replication strategies in query-based wireless sensor networks. Subsequently, we formulate and solve an optimization problem to select the resource replication level that minimizes an aggregate measure of network energy expenditure.

3 - A Cutting Plane Algorithm for Solving the Large-scale Broadband Convergence Network Design Problem

Gigyoung Park, Korea University, Sungbuk Ku Anam Dong 5-1, Seoul, Korea, Republic of, shadowpp@korea.ac.kr, Sunseok Lee, Noik Park, Youngwook Kim, Youngho Lee

We present an exact algorithm for solving a large scale network design problem of broadband convergence access networks. We formulate the problem as a three level hierarchical location-allocation model with nonlinear QoS constraints. We present promising computational results of the new disjunctive cuts that significantly enhance LP lower bounds.

4 - Fundamentals of Wireless Network Research

Timothy Matis, Texas Tech University, Dept of Industrial Engineering, Box 43061, Lubbock, TX, 79409, United States of America, timothy.matis@ttu.edu

The OR community has developed several models related to optimizing the QoS of wireless networks over the past several years. Notwithstanding, many of these ignore fundamental aximoms related to the physical transmission of a wireless signal. In this presentation, we consider several of these axioms, and comment on how several OR models could be improved to increase fidelity.

■ TD19

C-Room 28D, Upper Level

Tutorial: Warehouse Design and Open Research Issues

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu

1 - Operations Research in Warehouse Design

Leon McGinnis, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, leon.mcginnis@isye.gatech.edu, Russell Meller

This tutorial will address the question: "Of what practical value is OR in warehouse design?" The panelists will begin by discussing "real" warehouse design, and the role of OR — especially computational models — in the warehouse design process. The discussion will then turn to opportunities for both interesting OR research and practical OR applications in warehouse design.

■ TD20

C-Room 28E, Upper Level

Supply Chain Design

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Nizar Zaarour, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zaarour.n@neu.edu

1 - An MIP Reverse Logistics Network Model for Product Returns

Nizar Zaarour, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zaarour.n@neu.edu, Emanuel Melachrinoudis, Marius Solomon, Hokey Min

An MIP model for the reverse logistics network of product returns is presented and analyzed. The special problem structure, consisting of one initial collection point and one centralized return center is modeled and solved for the best tradeoff between inventory carrying costs and shipping costs. Key words: Reverse logistics, consolidation, network design

2 - Transportation and Inventory Trade-offs in Multiperiod Distribution System Models

Debra O'Connor, Assistant Professor, College of the Holy Cross, One College Street, Worcester, MA, 01610, United States of America, doconnor@holycross.edu, Agha Iqbal Ali

Two determinants of computational intractability of multiperiod distribution models are the spatial characteristics, and the trade-off between transportation and inventory costs. This paper develops echelon-flow-based valid inequalities using truckload-equivalents of required flows, and aggregated variable reduction based on truck-load-inventory-value to strengthen the underlying relaxation. Computational testing reveals that the strengthened model can reduce the duality gap by up to 99%.

3 - Effects of Advance Demand Information on Supply Chain Order Stability: An Experimental Study

Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 1209 Newmark Laboratory, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, yfouyang@illinois.edu, Onur Pekcan, Baris Aktemur

Many supply chains are known to suffer from the bullwhip effect; i.e., fluctuations in order sequences are usually larger for suppliers farther away from the customer. This talk presents an unstructured experimental study which demonstrates the potential to stabilize supply chain order sequences with advance demand information strategies. The experiments are carried out using a new Internet-based computer game where the operations of a multi-stage serial supply chain are simulated by players.

■ TD21

C-Room 30B, Upper Level

Emerging Areas: Transportation and Biofuels

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Seungmo Kang, University of Illinois at Urbana-Champaign, Room 1115, 1206 West Gregory Drive, MC-195, Urbana, IL, 61801, United States of America, skang2@illinois.edu

1 - Biofuel Refinery Location and Biomass Transportation Planning

Yun Bai, University of Illinois at Urbana-Champaign, B156 Newmark CE Lab, 205 N Mathews,M/C 250, Urbana, IL, 61801, United States of America, yunbai1@illinois.edu, Seungmo Kang, Yanfeng Ouyang, Taesung Hwang

This research focuses on planning biofuel refinery locations where the total system cost for refinery construction and biomass transportation is minimized. Biomass shipment routing and the resulting traffic congestion are incorporated into the decision on refinery locations. A Lagrangian relaxation based heuristic algorithm is integrated within a branch and bound framework to solve the proposed model. Numerical examples will also be presented.

2 - Multi-Period Facility Location Model for Optimizing the Bioethanol Infrastructure

Seungmo Kang, University of Illinois at Urbana-Champaign, Room 1115, 1206 West Gregory Drive, MC-195, Urbana, IL, 61801, United States of America, skang2@illinois.edu, Yanfeng Ouyang, Jürgen Scheffran, Hayri Onal, ‹. Deniz Tursun

This research presents a mathematical programming model and a case study for determining optimal locations and capacities of biorefineries, delivery of bioenergy crops, and processing and distribution of both ethanol and co-products (DDGS). The model aims to minimize total system costs in a multi-year planning horizon for both corn and cellulose based biorefineries.

■ TD22

C-Room 30C, Upper Level

Air Traffic Management

Contributed Session

Chair: Alex Nguyen, University of Maryland, 2247 A.V. Williams Building, College Park, MD, 20724, United States of America, alexatn@umd.edu

1 - An Integrated Traffic Flow Management Design Tool

George Hunter, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States of America, nwenderl@sensis.com, Krishnakumar Ramamoorthy

The traffic flow management problem is intimately related to the system demand, and has implications for the environmental impact and the cost of system upgrades and operation. Here we present an integrated analysis and design tool that leverages aggregate-level models for demand, traffic flow management, environmental impact and costs. We focus on the traffic flow management aggregate model.

2 - Predicting Sector Transit Times to Support Adaptive Eulerian Traffic Flow Modeling

Aditya Saraf, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States of America, Aditya.Saraf@Sensis.com, Peter Yu, David Rappaport, Katy Griffin

Deriving aggregate (Eulerian) air-traffic flow models requires accurate prediction of future control-volume aircraft counts. This paper presents a method for accurate prediction of sector transit time and sector aircraft counts as a function of sector geometry, sector traffic pattern, sector aircraft count, weather in the sector, aircraft-type and other factors.

3 - Commercial Air Travel Network: An Inventory Approach

Dipasis Bhadra, Senior Economist, FAA/DOT, 800 Independence Avenue, Washington, DC, DC, 20591, United States of America, dipasis.bhadra@faa.gov

How did air traffic network evolve in the US over time? Are the changes transitory or permanent; systematic or random? By creating an inventory of observed networks over time, we put forward a simple pattern recognition model that establishes the links between observed network now and those in the past. This simple framework can be used for understanding air traffic network with respect to size of the markets, types of competition, geospatial features, and structural changes.

4 - Very Light Jets Provide Opportunities for Changing the Business Travel Market

Dennis Mathaisel, Professor, Babson College, Babson Hall, Babson Park, MA, 02457-0310, United States of America, mathaisel@babson.edu, Clare Comm

Very Light Jets provide a personal, direct, on-demand, air taxi service to the business traveler. This paper presents an approach on how to change the behavior of the business traveler to use this service and an innovative technique for optimally scheduling the service to minimize costs.

5 - Network Cell Air Traffic Routing Model for Control of Throughput and Delay

Alex Nguyen, University of Maryland, 2247 A.V. Williams Building, College Park, MD, 20724, United States of America, alexatn@umd.edu, John Baras

We propose a new approach in leveraging the highway cell transmission model (CTM) to the airspace in the form of a multiobjective optimization that trades between maximizing throughput and minimizing delay. The main flows of air traffic are determined via a clustering method and converted into a network of cells. The model is a multicommodity traffic flow Integer Program where the constraints are relaxed slightly from the CTM to examine strategies for achieving optimal throughput and delay.

■ TD23

C-Room 30D, Upper Level

Simulation of Military Systems

Sponsor: Military Applications Society

Sponsored Session

Chair: Rob Kewley, Director, Operations Research Center, West Point Dept of Systems Engineering, 4th Floor Mahan Hall, West Point, NY, 10996, United States of America, robert.kewley@usma.edu

1 - Marine Corps Systems Command TLCSM Discrete Event Modeling and Simulation Tool

Stephen Mount, Major, Marine Corps Systems Command, 2200 Lester Street, Quantico, Va, 22134, United States of America, stephen.mount@usmc.mil, Thomas Turner

Marine Corps Systems Command has recognized the need to make Total Life Cycle Systems Management (TLCSM) decisions based upon readily available, web-based, maintenance and availability data. Using Microsoft Excel and the ExtendSim modeling environment, a flexible and modular model was developed to provide Program Managers with insight into the implications associated with different operational supply chain management and business case decisions as they relate to a particular weapons system.

2 - A Simulation Study of Stochastic Combat Networks

Yoon G Hong, Professor, Hansung University, 38, 2-Ga Samseon-dong Sungbuk-gu, Seoul, 136-792, Korea, Republic of, yhong@hansung.ac.kr, Hyun J Min

As military technology has developed, military analysts have growing interest in combat network systems. This study considers two different force moving rules to express a more realistic situation in the analysis of mini-battle network problems. The results are compared to the existing models. This study suggests some further works which need to be investigated. These include force allocation, moving speed, tactics, weather, and topography, etc.

3 - A Strategic Capability-based Force Structure Simulation

Alex Bourque, Defence Research and Development Canada, 101 Colonel By Drive, Ottawa, ON, K1A 0K2, Canada, alex.bourque@drdc-rddc.gc.ca, Cheryl Eisler

Tyche is a discrete-event Monte Carlo scheduling simulation tool developed to carry out joint force structure analysis within the Canadian military context. Fleets of assets are tested against a future security environment, and matching between the demand and the supply is done by using capabilities. Several constraints including personnel tempo can be factored in. This presentation describes the salient features of Tyche and how it can be used for force structure analysis.

■ TD25

C-Room 31A, Upper Level

Optimization Models in Air Traffic Flow Management

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Michael Ball, Robert H Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, mball@rhsmith.umd.edu

1 - Fairness in Air Traffic Flow Management

Shubham Gupta, PhD Student, M.I.T, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, shubhamg@MIT.EDU, Dimitris Bertsimas

We study fairness in Air Traffic Flow Management (ATFM). The existing models for ATFM do not impose controls on the number of pairwise reversals and the distribution of delays across airlines. We formulate these two "fairness" controls as integer programming models. Moreover, we provide empirical results of the proposed optimization models on real world, national-scale datasets spanning across six days that illustrate that the proposed models successfully address these "fairness issues".

2 - Departure Runway Management with Queue Assignment

Gautam Gupta, Associate Research Scientist, University Affliliated Research Center, Building 210, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States of America, ggupta@ucsc.edu, Waqar Malik, Yoon Jung

A mixed integer linear program for departure runway management is developed. The model does runway queue management and schedules departure aircraft as well as arrival aircraft runway crossing to maximize runway throughput. The model incorporates (optional) prioritization of certain departing aircraft and different methods of queue management (first in first out, dedicated lane for high priority flights and others). We present computational results and implementation methods under uncertainty.

3 - Optimal Selection of Airport Runway Configurations

Michael Frankovich, Graduate Student, MIT, 77 Massachusetts Ave, Building E40-149, Cambridge, MA, 02139, United States of America, mfrankov@MIT.EDU, Dimitris Bertsimas, Amedeo Odoni

We present a mixed integer programming formulation to solve the problems of (i) selecting an airport's optimal sequence of runway configurations, and (ii) determining the optimal balance of arrivals and departures to be served at any moment. Large realistic problem instances are solved within several minutes. Furthermore, comparison to a baseline heuristic reveals that the potential cost reduction is significant.

4 - Computationally Tractable Stochastic Integer Programming Models for Air Traffic Management

Charles N. Glover, Doctoral Candidate, University of Maryland, 3117 A.V. Williams Building, College Park, MD, 20742, United States of America, cnglover@math.umd.edu, Michael Ball

Convective weather is a major contributor to air traffic delays. There is much uncertainty associated with weather predictions, so stochastic models are necessary to assign ground delay and route adjustments to flights. We describe a multi-period stochastic integer program for this problem. We show that under certain conditions the LP-Relaxation yields integer optimal solutions. For more general cases we compare the strength of alternate formulations and provide tractable formulations.

■ TD26

C-Room 31B, Upper Level

Risk Management in Cost Estimation

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Geoffrey Berlin, Federal Aviation Administration, 1701 Columbia Avenue, College Park, GA, 30337, United States of America, Geoffrey.Berlin@faa.gov

1 - Integrating Cost & Schedule Risk Analysis to Promote Program Success

Eric Druker, Booz Allen Hamilton, 8283 Greensboro Drive, McLean, VA, 22102, United States of America, druker_eric@bah.com, Booz Allen Hamilton

Although undeniably related, cost estimating, schedule estimating and risk management are traditionally practiced as separate functions. Noticing this shortcoming, and desiring to better predict their program's final costs & schedules, agencies such as NASA are beginning to set policy aimed at finally uniting these three, formerly independent, activities. This presentation will discuss the emergent field of integrated cost & schedule risk analysis. It will begin with a discussion of the reasons for this integration and the process by which it is accomplished. It will then focus on the general integration methodology, including how the cost estimate, integrated master schedule and risk management plan are united in the analysis and what tools and methods are utilized to analyze risk. The presentation will conclude with a primer on how program managers can use the results of the integrated risk analysis to: better understand the relationship between cost and schedule on their program, prioritize and mitigate risks based on their cost and schedule impacts and develop and defend contingency (or reserve) positions to ensure that programs have a high probability of coming in at cost and schedule.

2 - Balancing Risk in FAA's Estimating Process for Flight Inspection Costs

Geoffrey Berlin, Federal Aviation Administration, 1701 Columbia Avenue, College Park, GA, 30337, United States of America, Geoffrey.Berlin@faa.gov

The most conservative approach to estimating a cost is to consider the most costly, or worst case estimate. This approach almost guarantees that a project will always be completed within budget. However, this approach also leads to inefficient use of governmental funds and significantly limits the number of projects that will be initiated in any given year. An example of the FAA's initiative to promote efficient allocation of financial resources is the Flight Inspection Model. The flight inspection cost model assists in estimating the cost of a commissioning type flight inspection of an Instrument Landing System (ILS). The model is based upon statistics derived from historical flight inspection times incurred by the FAA's Flight Inspection Operations Group. These statistics showed that the flight inspection times for all ILS components closely followed a Gamma probability distribution. The cost model uses these statistics and the Gamma distribution as the basis for generating risk adjusted estimates. The model generates a risk adjusted estimate of the flight time required to complete a flight inspection of an ILS.

3 - Making Statistical Analysis Accessible: The RAMS Tool for Performing Regression and Risk Analysis

Matt Lytton, Booz Allen Hamilton, 8283 Greensboro Drive, McLean, VA, 22102, United States of America, Lytton_Matthew@bah.com, Eric Druker, Booz Allen Hamilton, Gregory Hogan

Early on in program development it is generally the case that cost and schedule are predicted based on high-level parametric estimates. Despite this being the phase where the least is known about the program, it is more often than not the point in time at which future budgets are developed. Because of this fact, it is vitally important that the most robust cost and schedule estimating techniques be utilized. Cost and schedule estimating relationships (CERs and SERs) are regression equations, derived using statistical analysis, used to predict cost and schedule based on a program's technical parameters. Many of the common tools for developing CERs and SERs (such as Microsoft Excel) contain the functionality required to perform statistical analysis, but without any context required to interpret the results. To this end, Booz Allen has developed the Regression & Risk Analysis Methodology Streamliner (RAMS tool). The RAMS tool automates regression analysis for the development of CERs and SERs including features that explain the results and how they relate to the cost estimate. Additionally, it takes estimates developed using these CERs and SERs and automatically converts them into risk distributions. This integrating of cost estimating and risk analysis allows program managers to make budgeting decisions that will help ensure their program has adequate reserves to cover future cost and schedule growth.

4 - Tools, Data, and Results for Estimating Risk in Lifecycle Cost Estimates

Mike Shoecraft, Cost Analyst, SPAWAR 1.6, Space and Naval Warfare Systems Command, 4301 Pacific Hwy, San Diego, CA, 92110, United States of America, Mike.Shoecraft@navy.mil

The Weapon System Acquisition Reform Act of 2009 requires Major Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAISs) to justify the selection of a confidence level of less than 80% for their cost estimates. This presentation provides several tools, data, and results for estimating cost risk for lifecycle costs for large software development efforts within the Space & Naval Warfare Systems Command.

■ TD27

C-Room 31C, Upper Level

Simulation Optimization I

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Leyuan Shi, Professor, University of Wisconsin-Madison, 3250 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, leyuan@engr.wisc.edu

1 - Simulation Optimization Using COMPASS in High Dimensions

Barry L Nelson, Professor, Northwestern University, Department of Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu, Jie Xu

Convergent optimization via most promising area stochastic search (COMPASS), and its implementation in Industrial Strength COMPASS (ISC), is designed to converge with probability 1 to a locally optimal solution for stochastic simulation optimization problems with integer-ordered decision variables. We describe and evaluate enhancements of ISC to make it more efficient for higher dimensional decision variables.

2 - Monte Carlo Inference for Stochastic Root Finding

Raghu Pasupathy, Assistant Professor, Virginia Tech, 221 Durham Hall, Blacksburg, VA, 24061, pasupath@vt.edu

Our broad focus in this talk is Monte Carlo inference for sample average approximation (SAA) estimators within stochastic root finding problems (SRFPs). Some specific questions we tackle include: (i) when and at what rate do SAA solutions to SRFPs converge? (ii) what is the complexity of stochastic root finding? (iii) can minimum sample size rules and sequential sampling schemes be devised to identify solutions of a specified quality? Key results are illustrated through a numerical example.

3 - Nested Partitions with Statistical Promising Indices

Weiwei Chen, Student, University of Wisconsin-Madison, 3247 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, wchen26@wisc.edu, Leyuan Shi, Zhengjun Zhang

Nested Partitions (NP) is a partitioning and sampling-based algorithm for large-scale optimization. It guides the search on the promising regions, determined by promising indices. We propose statistical promising indices for NP. It can speed up the algorithm, and be used to estimate the success probabilities of NP moves, which are useful in determining a good algorithm setting. Statistical bounds can be obtained, when theoretical bounds are not effective. Numerical examples show good results.

4 - The Instance Risk of Simulation-Based Optimization Algorithms

Qing-Shan Jia, Tsinghua University, Beijing, 100084, China, jiaqs@tsinghua.edu.cn, Qianchuan Zhao

Most previous simulation-based stochastic optimization algorithms focus on the average performance of these algorithms over multiple runs. In this paper we make a first study on the instance risk which measures the risk for an algorithm to output a set of nonsatisfactory designs after a single run on a single problem instance. This instance risk is of great practical interest when each simulation is time-consuming.

5 - Can OR be Used to Optimize Business Strategy? Stochastic Optimization Might Hold the Key

Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Strategic planning decisions are not easily modeled with classic optimization techniques. Using agent-based Monte Carlo simulation, stochastic optimization, and grid computing, Vanguard Software built a drug development pipeline model

for Novartis Vaccines & Diagnostics which forecasts performance and optimizes the acquisition schedule for new drugs. In this presentation, we discuss lessons learned and practical issues such as designing consensus objective functions and communicating results.

■ TD28

H-Room 500, Fifth Floor

Non-parametric Data-Driven Methods in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Huseyin Topaloglu, Cornell University, School of ORIE, Rhodes Hall, Ithaca, NY, 14853, United States of America, ht88@cornell.edu

1 - Stochastic Approximation for Computing Bid Prices for Overbooking over an Airline Network

Huseyin Topaloglu, Cornell University, School of ORIE, Rhodes Hall, Ithaca, NY, 14853, United States of America, ht88@cornell.edu, Sumit Kunnumkal

We present a stochastic approximation method to find a good bid price policy for making overbooking decisions over an airline network. Our approach views the total expected profit as a function of the bid prices and uses sampled derivates of the total expected profit to find a good set of bid prices. We present comparisons with standard benchmark methods and demonstrate substantial profit improvements.

2 - Computing Bid-prices for Revenue Management under Customer Choice Behavior

Gustavo Vulcano, Assistant Professor, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Juan Chaneton

We develop a stochastic approximation algorithm to compute bid prices for network revenue management, accounting explicitly for choice behavior effects. One of the main practical advantages of this proposal is that it can be built-in as an extra layer on current RM systems that implement bid-price controls. Our numerical experiments show that the approach has interesting potential from a revenue performance perspective.

3 - Mining Sales Person Decisions in Pricing

Itir Karaesmen, University of Maryland, 4357 Van Munchin Hall, College Park, MD, 20742, United States of America, ikaraes@rhsmith.umd.edu, Wolfgang Jank, Wedad Elmaghraby, Shu Zhang

In many B2B transactions, sales persons have significant responsibility in pricing decisions. Using a data set from a grocery products manufacturer, we study how sales people adjust price quotes for different products and different customers over time. We investigate what factors influence price adjustments and build a model to predict these price changes.

4 - The Pricing of Innovative Products with Upgrading and Advertising Decisions

Kevin D. Ferreira, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ferreira@mie.utoronto.ca, Chi Guhn Lee

We examine how a firm can use dynamic pricing, advertising, and upgrading decisions to influence how customers value their product; and how its acceptance diffuses throughout the market so that profits are maximized. We utilize a risk-adjusted, multi-attribute utility function to model the customer's valuation of the product, which is updated using a multi-source Bayesian approach. The likelihood that a customer will purchase the firm's product is formulated using discrete choice theory.

■ TD29

H-Room 501, Fifth Floor

Options Pricing in Energy Market

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Jieyun Zhou, Graduate Student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, jzhou@isye.gatech.edu

1 - A Fourier Transform Method for Pricing Options under Mean-reverting Pure Jump Processes

Li Xu, Graduate student, Goergia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30332, United States of America, lxu@gatech.edu, Tony Ware

Energy commodities, such as oil, gas and electricity, exhibit high volatilities, sudden jumps and long-run mean-reversion. We proposed a Fourier transform based method with semi-Lagrangian time stepping to evaluate European and American type contingent claims written on mean-reverting Levy-driven assets. The algorithm involves fast Fourier transform on non-equally spaced points and is applicable to any Levy processes. We carry out a numerical example of pricing put options under OU-VG processes.

2 - Empirical Analysis of Implied Volatility in the Nordic Electricity Market

Johan Sollie, Research Fellow, NTNU Norway, Department Industrial Econ and Technology Mgmt., Trondheim, NO-7491, Norway, johan.sollie@iot.ntnu.no, Stein-Erik Fleten, Magnus Muri Boberg, Andreas Lindal

In this article we investigate the relationship between implied volatility of traded options and observed volatility in the Nordic electricity market. We find that implied volatility preforms well as forecast of future volatility. The performance of Implied volatility is compared to other forecasts of volatility such as GARCH type models.

3 - Real Options Valuation for Natural Gas Storage

Jieyun Zhou, Graduate student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, jzhou@isye.gatech.edu, Shi-Jie Deng, Sandeep Jain

We propose a market-based valuation framework for valuing natural gas storage facility with realistic operational characteristics. We develop a fast and accurate numerical scheme to solve for the dynamically optimal spot trading strategy. Furthermore, we propose to value a storage based on a trading strategy which consists of both spot and forward tradings, thus improving the storage valuation by accounting for the inter-month and intra-month operation flexibilities.

■ TD30

H-Room 502, Fifth Floor

Energy I

Contributed Session

Chair: Joahnna Amaya, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, jamaya@ufl.edu

1 - Integer Programming and Network Flow Approaches for Solving Gas Transmission Problem

Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, andynfan@ufl.edu, Qipeng Zheng, Panos Pardalos

In this talk, the gas transmission problem is solved in the approaches of binary integer programming and some techniques from network flow optimization. Some numerical results and comparisons with other methods are also presented.

2 - An Overview of Algorithms and Models for Transmission Network Expansion Planning

Alexey Sorokin, University of Florida, 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States of America, sorokin@ufl.edu, Panos Pardalos, Steffen Rebennack

The Transmission Network Expansion Planning (TNEP) problem answers in an optimal way where new electricity circuits should be built and to what nodes new electricity lines should be connected in order to satisfy the forecasted demand. We present the state-of-the-art in TNEP modeling and solution techniques. Among these techniques are exact methods like linear and nonlinear programming, MIP and Benders decomposition as well as heuristic approaches such as GA and GRASP.

3 - Modeling Oil Supply Disruption Risk Using EVT and Copula

Kabir Katata, Doctoral Researcher, Warwick Business School, University of Warwick, Coventry, CV4 7AL, United Kingdom, kabir.katata07@phd.wbs.ac.uk, Nalan Gulpinar

Reliable quantitative analysis of oil supply disruptions is essential for governments and oil traders. Presently,disruption risk is not measured and therefore not insured.Oil supply disruptions are extreme events that can be rare and severe. We model the disruptive events and quantify the associated financial loss arising from such disruptions using extreme value theory (EVT).We also investigate the behaviour of oil and gas supply disruptions by considering their joint impact using copula.

4 - Updated Energy Balance Towards Optimization

Joahnna Amaya, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, jamaya@ufl.edu, Cristiàn Càrdenas

We present a study of both an initial and an updated energy balance resulting from an industrial energy audit. The new energy consumption and costs are presented to show associated savings. A numerical example is offered as a proof of this statement, with an optimization model. Further work is discussed.

■ TD31

H-Room 503, Fifth Floor

Pricing Under Uncertainty

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Javad Nasiry, Ph. D. Student, INSEAD, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Javad.NASIRY@insead.edu

1 - Pricing Access Services
Ozge Sahin, Assistant Professor, University of Michigan, Stephen M Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, ozge@bus.umich.edu, Guillermo Gallego

We consider how consumer's uncertainty in the valuations and the amount they will consume impact the demand over time and how the firm can exploit consumer's uncertainty in pricing decisions. We investigate the optimal structure of the contracts that a firm should offer in industries that charge access fees to consumers. We provide guidelines on pricing access services and warranties if the consumers are facing time inconsistency and have different risk preferences.

2 - Revenue Management for Online Advertising Using Advertising Networks
Sami Najafi-Asadolahi, PhD candidate, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, snajafi.phd2005@london.edu, Kristin Fridgeirsdottir

We consider a web publisher that generates revenues from displaying advertisements on its website. An advertising network supplies the publisher with advertisers that are charged according to the so-called cost-per-impression pricing scheme. We model the publisher's operation as a queueing system where advertising slots correspond to servers. We derive a closed-form solution for the system's steady-state probabilities, determine the optimal price and provide managerial insights.

3 - Advance Selling, Strategic Consumers and Competition
Pnina Feldman, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, pninaf@wharton.upenn.edu, Gerard Cachon

Advance selling has been shown to provide the firm with higher profits than spot selling. We investigate whether this continues to hold when firms compete in an environment of strategic consumers. We examine the effect of advance selling strategies on consumers' purchasing behavior, the firms' equilibrium prices and capacities and their expected payoffs.

4 - Dynamic Pricing When Consumers Regret
Javad Nasiry, Ph. D. Student, INSEAD, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Javad.NASIRY@insead.edu, Ioana Popescu

We model the dynamic pricing problem of a monopolistic firm in a two period market where consumers are prone to regret. Sophisticated consumers anticipate regret and make decisions to maximize their surplus, net of regret. We characterize consumer behavior in the presence of regret in this dynamic setting, and investigate the firm's optimal selling and pricing structure under various scenarios.

■ TD32

H-Room 504, Fifth Level

Option Pricing and Applications

Contributed Session

Chair: Hongyan Chen, Missouri University of Science and Technology, 1208 N Oak Street, Apt. 1, Rolla, MO, 65401, United States of America, wdy525@gmail.com

1 - Pricing of Multiple Exercisable Real Options
Yu Meng, PhD Candidate, Missouri University of Science & Technology, 223 Engineering Management, 600 W. 14th St., Rolla, MO, 65409-0370, United States of America, ym3g7@mst.edu, Zhen Liu

We propose a general framework for valuing multiple exercisable real options, where an expansion option must be exercised before an abandonment option. Using the Binomial Tree Pricing Model, we show how to determine the value of the options and account for the interaction among them.

2 - Monte Carlo Option Pricing When the Underlying Security Price Follows a Jump-diffusion Process
Samim Ghamami, University of Southern California, 3215 Overland Ave, Apt # 7176, Los Angels, 90034, Los Angeles, CA, 90034, United States of America, ghamami@usc.edu, Sheldon M. Ross

We introduce efficient simulation procedures for pricing barrier options when the underlying security price follows a geometric Brownian motion with jumps. Our proposed Monte Carlo estimators of both knock-out and knock-in barrier options lead to significant variance reduction compared to the raw simulation estimator introduced by Metwally and Atiya (2002).

3 - Decision-making Tool for Project Investments Based on Real Options (Case: Wind Power Generation)
Jose I. Munoz, Dr., University of Castilla - La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, 13071, Spain, joseignacio.munoz@uclm.es

1st: The volatilities of market prices and wind regimes are obtained from GBM-MR and Weibull models. From these and other values the NPV curve of the investment is calculated, as well as its average volatility. 2nd: A real options valuation method is applied. The volatility of the NPV curve is inserted into a trinomial investment option valuation tree. In this way, it's possible to calculate the probabilities of investing right now, deferring the investment, or not investing at all.

4 - Portfolio Selection Under Discrete Choice Constraints
Stephen J. Stoyan, University of Southern California (USC), Daniel J Epstein Department of Industrial and Systems Engineering (ISE), 3715 McClintock Avenue, Los Angeles, CA, United States of America, stoyan@usc.edu, Roy Kwon

We present portfolio selection models subject to discrete choice constraints. Designing portfolios that consider current managing constraints is challenging due to the need to hold many securities and include a rebalancing strategy. We consider two portfolio models that incorporate a comprehensive set of real world constraints, of which both focus on the number of securities to hold. Uncertainty is included in the design using a two-stage stochastic mixed-integer program. The resulting problems use two different model specific algorithms to generate solutions in reasonable time.

5 - An Option for Improved Public-private Partnership in BOT Projects
Hongyan Chen, Missouri University of Science and Technology, 1208 N Oak Street, Apt. 1, Rolla, MO, 65401, United States of America, wdy525@gmail.com, Ruwen Qin

We design an option for improved public-private partnership. In a Build-Operate-Transfer (BOT) project the right that the public entity offers to the private entity to continue operating the project after the concession term expires is modeled as an European option. Results show a BOT contract with such option motivates the private entity to augment the capital investment for greater benefits, and meanwhile, helps the public entity reduce its risk under unfavorable future conditions.

■ TD33

H-Room 505, Fifth Floor

Supply Chain Management

Cluster: Economic Models in Operations Management
Invited Session

Chair: Fernando Bernstein, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States of America, fernando@duke.edu

1 - Competitive Pricing with Strategic Customers
Dan Zhang, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, dan.zhang@mcgill.ca, Qian Liu

We consider competitive pricing between two sellers when a portion of the customers is strategic. We first study the perfect information competition. We then consider the case where firms may have uncertainty around strategic customer behavior. We discuss the implications of our results.

2 - Implications of a Site-to-Store Channel for Supply Chain Performance
Shuya Yin, Assistant Professor, University of California-Irvine, Paul Merage School of Business, Irvine, CA, 92697, syin@exchange.uci.edu, Rick So, James Cao

As internet retailing has become increasingly prevalent, firms have continued to innovate by adopting multi-channel strategies. One of these innovations is the introduction of a distribution channel, commonly known as site-to-store, where consumers can purchase online and pick up in-store. In this project, our focus is on understanding the effects of the site-to-store channel on the retailer's pricing strategy, profitability, and demand realization.

3 - Advance Purchase Contracts in a Multi-location System with Transshipment
Pengfei Guo, Assistant Professor, Hong Kong Polytechnic University, Hung Hum, Kowloong, Hong Kong, Hong Kong - PRC, lgtpguo@polyu.edu.hk, Yulan Wang, Fernando Bernstein

Under an advanced purchase contract, a retailer is offered two ordering opportunities: an early order, at a discounted price, before the supplier starts production, and a late order, at regular price, after observing demand. In this project, we explore the use of an advanced purchase contract by a firm that sells its products through multiple retail locations and has the ability to transship inventory between these locations.

■ TD34

H-Room 520, Fifth Floor

Joint Session OR-Societal Impact/TSL: Logistics and Response in Large-Scale Disaster

Cluster: OR/MS with Societal/ Humanitarian Impact & Transportation Science and Logistics
Invited Session

Chair: Lisa (Lichun) Chen, University of Maryland, 1173 Glenn Martin Hall, Department of Civil and Environmental Eng, College Park, MD, 20742, United States of America, lcchen@umd.edu

1 - Simulating Catastrophes for Disaster Management
Pamela McCauley Bush, Associate Professor, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL 32816, United States of America, mcbush@mail.ucf.edu, Steven A. Diaz, Maria Teressa Bull, Yanshen Zhu, Asli Soyler

This paper presents a dynamic simulation tool for managing the complex disaster systems which partitions behavioral and functional components into discrete time periods by creating a platform that integrates information from different models. Predicted impact of the disasters on the population is used for supporting USACE with their mitigation plans and optimization in agency distribution and evacuation plans.

2 - Pre-positioning Planning for Emergency Response with a Reliability Constraint
Mark Turnquist, Professor, Cornell University, 309 Hollister Hall, Ithaca, NY, 14853, United States of America, mat14@cornell.edu, Carmen Rawls

We describe a stochastic optimization model that determines locations and capacities of emergency distribution centers and allocates inventories of multiple relief commodities. In addition to costs and penalties for not meeting demands, the model includes a reliability constraint to ensure that in at least R% of considered scenarios, the average distance each commodity type has to be moved is less than a specified limit. A case study using hurricane threats is used to illustrate the model.

3 - Sheltering Network Design and Management Responding to Natural Disasters
Mingzhou Jin, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, mjin@ise.msstate.edu, Lingfeng Li

The paper considers sheltering network design and operations for disaster responses with a two-stage stochastic program. The first phase decides locations and capacities of permanent shelters. The second phase allocates evacuees and resources to shelters. The Bender's decomposition is applied. Each sub-problem is a linear program and could be modeled as the network flow problem with general equal flows. The numerical experiments demonstrate that the decomposition converge well.

4 - Solving the Urban Search and Rescue Team Deployment Problem
Elise Miller-Hooks, Associate Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, elisemh@umd.edu, Lisa (Lichun) Chen

The problem of optimally deploying multiple homogeneous USAR teams to disaster sites within a disaster region, and ordering the site visits, such that the expected number of saved lives is maximized over a given horizon is addressed. The number of people in need of assistance and the time required to serve them are random. The problem is formulated and techniques are presented for their solution.

■ TD35

H-Sapphire A, Fourth Floor

Stochastic Programming and Cost Effectiveness Applications in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Osman Ozaltin, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, oyo1@pitt.edu

1 - Designing Primary Care Physician Panels
Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu, Brian Denton, James Stahl

We present a stochastic programming framework to help determine the optimal size and composition of physician panels in primary care. Our objectives are two measures important for any practice: timely access, which provides patients with appointments whenever they need care; and continuity of care, which tries to have patients see their own assigned physician and develop a long-term patient-physician relationship. We analyze results using data from the primary care practice at the Mayo Clinic.

2 - Optimizing Annual Flu Shot Design and Timing
Osman Ozaltin, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, oyo1@pitt.edu

Seasonal flu epidemics, which are caused by antigenic drifts and high rate of transmission, may require annual updates in the flu shot composition. The World Health Organization recommends which flu strains to include in the annual vaccine based on surveillance and epidemiological analysis. We formulate a multistage stochastic mixed-integer program, which quantifies the trade-off between the composition and timing decisions. We carefully calibrate our model and derive fast solution techniques.

3 - Cost-effectiveness of Bariatric Surgery as a Treatment for Type 2 Diabetes
Cindie Wu, Student, Stanford University, 218 Ayrshire Farm Lane, Apt. 304, Stanford, CA, 84305, United States of America, cindiewu@stanford.edu

The growing prevalence of diabetes is a concern in the US, but morbidly obese patients who have bariatric surgery experience remarkable rates of diabetes remittance aside from weight loss. Our Markov model determines the cost-effectiveness of bariatric surgery, relative to non-operative therapy, as treatment for Type 2 diabetes in moderately overweight individuals, who are not currently eligible for bariatric surgery. Expanding to include this cohort may improve diabetes management standards.

■ TD36

H-Sapphire B, Fourth Floor

Health Care Access

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Organizing Outpatient Clinics: The Viability of Walk-in Based Policies
Nikky Kortbeek, PhD Candidate, University of Twente, Drienerlolaan 5, Enschede, 7500AE, Netherlands, N.Kortbeek@ewi.utwente.nl, Maartje Zonderland, Richard Boucherie, Nelly Litvak

Outpatient clinics and diagnostic testing facilities traditionally provide patients with individual appointments to balance workload. Disadvantages however, include patients needing to revisit the hospital, an involved planning process and potentially long access times. This study explores the viability of various walk-in based policies. We present a stochastic method that finds the mixed strategy that optimally balances the benefits and drawbacks of the pure appointment and walk-in policies.

2 - Improving Patient Flow at the Foothills Hospital Orthopedic Clinic
Tom Rohleder, Senior Associate Consultant, Mayo Clinic, Div. of Health Care Policy and Research, 200 First Street SW, Rochester, MN, 55905, United States of America, rohleder@mayo.edu, Paul Duffy, Peter Lewkonia

We report on a process improvement project aimed at reducing patient congestion and waiting time in a cast clinic. This case study shows how simulation modeling was used to reduce patient waiting times without significantly increasing the clinic's total hourly length. After implementing an improved scheduling approach in the clinic, the average waiting time was reduced by about 30 minutes per patient with only a small increase in the overall clinic length.

3 - Home Health Care Services: Models and Algorithms
Stefan Nickel, Insitute for Operations Research, Universitaet Karlsruhe (TH), Geb. 11.40, Karlsruhe, Germany, stefan.nickel@kit.edu, Michael Schroeder, Joerg Steeg

Home health care (HHC) services provide nursing assistance to the elderly with the advantage of allowing them to continue a life at their homes. Usually a HHC service has a fleet of vehicles that are used by nurses with different qualification levels to get to the patients, where they have to perform a specified job. The HHC problem can be stated as follows: assign a nurse to each patient such that several conflicting objective functions are minimized, while a number of constraints are met.

■ TD37

H-Sapphire C, Fourth Floor

Empirical Research on Supply Chain Management

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu

1 - Impact of Performance Based Contracting on Product Reliability: An Empirical Analysis

Jose A. Guajardo, Ph.D. student, The Wharton School, University of Pennsylvania, 3730 Walnut st. JMHH suite 500, Philadelphia, United States of America, josegu@wharton.upenn.edu, Morris A. Cohen, Sang-Hyun Kim, Serguei Netessine

In this paper, we empirically investigate the impact of contract incentives on product reliability. Using a proprietary dataset provided by a major manufacturer of aircraft subsystems, we estimate a two-stage model that explicitly takes into account the inherent endogeneity in contract choice by the customer. The analysis provides evidence for the positive and significant effect of performance incentives on product reliability.

2 - Global Sourcing: The Role of Mismatch Costs

Karan Girotra, Assistant Professor, INSEAD, Boulevard De Constance, Fontainebleau, France, karan.girotra@insead.edu, Taylor Randall, Marcelo Olivares

We combine multiple data sources covering global trade flows, sales and inventory trends to identify patterns in global sourcing. We then attempt to understand the drivers of these trends and study their implications on operational performance.

3 - On the Link Between Joint Inventory/Sales Dynamics and Financial Performance

Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Sergey Rumyantsev

Using financial accounting panel data from the COMPUSTAT database for a universe of all inventory-carrying companies in the period from 1994 to 2003, we develop a statistical methodology that links managerial decisions about inventory with accounting returns.

4 - Estimating the Effect of Inventory on Demand

Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, 10027, United States of America, molivares@columbia.edu, Gerard Cachon

We develop an estimation strategy to measure the effect of inventory on sales. We seek two identify to separate mechanisms: (1) a censored demand effect, where changes in inventory affect lost sales; (2) a "billboard" effect where changes in inventory affects demand directly, for example, by increasing customer awareness of the product. We use our estimation methodology with data from DVDs sold at 300 stores of a major big-box retailer.

■ TD38

H-Sapphire D, Fourth Floor

Data Driven Algorithms for Stochastic Inventory Control

Cluster: Inventory Management
Invited Session

Chair: Retsef Levi, Assistant Professor, Sloan, School of Management, MIT, 50 Memorial Drive Building E53-389, Cambrideg, MA, 02142, United States of America, retsef@MIT.EDU

1 - Managing Inventory in the Presence of Finite Historical Demand Data

Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu, Alp Akcay, Sridhar Tayur

We consider the practical situation where the demand distribution and the values of its parameters are unknown and only a finite amount of historical demand data is available. We quantify the inaccuracy in the inventory policy estimation and set inventory targets in the presence of this finite data. Our procedures can be easily implemented in practical settings.

2 - The Repeated Newsvendor Problem with Expert Advice

Tim Huh, Columbia University, 500 West 120th St, New York, United States of America, th2113@columbia.edu, Thiam Lee

We consider the finite-horizon repeated newsvendor problem with changing and unknown demand in the presence of two experts who provide stocking-level recommendations. As a proxy to handle the consequent complexities, the expert recommendations and demand outcomes are chosen by an adversary. Our goal is to minimize the regret from not having chosen the a posteriori better expert to follow from the onset. We give an optimal algorithm to solve this problem and analyze its asymptotic performance.

3 - Data-Driven Approaches for Newsvendor Models

Joline Uichanco, PhD candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, uichanco@MIT.EDU, Retsef Levi, Georgia Perakis

We consider the single-period newsvendor problem. Given the demand distribution, the optimal order quantity is known. Usually, only past demand data is available. A heuristic approach uses the empirical distribution as a proxy. We show theoretical bounds on the samples needed for the heuristic to be epsilon-close to the optimal cost. We also provide a tighter bound for distributions with log-concave densities. This bound is close to the number of samples observed in simulation experiments.

■ TD39

H-Sapphire E, Fourth Floor

Strategic and Tactical Procurement in Supply Chain

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Xinxin Hu, Assistant Professor, Indiana University, 1309 East 10th Street, Bloomington, IN, 47405, United States of America, hux@indiana.edu

Co-Chair: Shanshan Hu, Assistant Professor, Indiana University at Bloomington, hush@indiana.edu

1 - Group Buying Mechanisms under Quantity Discounts

Rachel Chen, Assistant Professor, University of California at Davis, rachen@ucdavis.edu, Cuihong Li, Rachel Zhang

When a seller offers quantity discounts, interested buyers may either self-organize or rely on a third party to aggregate their purchasing quantities to obtain lower prices, referred to as group buying. A group buying mechanism determines the amount each buyer will purchase and the price each buyer will pay. In this paper, we study buyers' purchasing behavior and surplus given a seller's quantity discount schedule under both the uniform and non-uniform price group buying mechanisms.

2 - Integrated Optimization of Procurement, Processing and Trade of Commodities

Sripad Devalkar, PhD student, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, devalkar@bus.umich.edu, Ravi Anupindi, Amitabh Sinha

Motivated by the operations of a prominent commodity processing firm, we consider the integrated optimization problem of procurement, processing and trade of commodities over a network in a multiperiod setting. For a risk-neutral decision maker, we show that the single-node version of this problem can be solved optimally and develop tractable heuristics for the multi-node network problem. Additionally, we also discuss some results for the risk-averse case.

3 - Unit-Price Procurement Auctions with Asymmetric Information

Shanshan Hu, Assistant Professor, Indiana University at Bloomington, hush@indiana.edu, Qing Ye, Roman Kapuscinski, Uday Rajan

We study the impact of asymmetric information in procurement auctions and compare discriminatory and uniform formats. When suppliers' costs are private information, the equilibrium is jointly controlled by a supplier relative size and uncertainty about costs. When capacities are private information, discriminatory auctions always have monotone equilibrium, where supplier's bids decrease in capacity, while revenues increase. For uniform auctions, monotone equilibrium does not necessarily exist.

■ TD40

H-Sapphire H, Fourth Floor

Pricing Problems in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Hyun-soo Ahn, University of Michigan, Stephen M Ross School of Business, 701 Tappan Street #4428, Ann Arbor, MI, 48109, United States of America, hsahn@umich.edu

Co-Chair: Goker Aydin, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, ayding@umich.edu

1 - Supply Chain Efficiency and Contracting in the Presence of Gray Market

Mehmet Altug, Columbia University, 3022 Broadway Uris Hall, New York, NY, 10027, United States of America, maltug10@gsb.columbia.edu, Garrett van Ryzin

We consider a supply chain with one manufacturer and several authorized retailers that face uncertain demand and a potential gray market. While the gray market can be seen as an opportunity to sell any excess inventory, it also is a threat for authorized retailer's demand. We characterize the equilibrium market-clearing gray market price and retailers' quantity decision. We compare decentralized and centralized system and show that wholesale pricing contract itself is "almost" coordinating.

2 - Dynamic Pricing of Limited Inventories When Customers Negotiate

Chia-Wei Kuo, Assistant Professor, National Taiwan University, 85 Sec 4, Roosevelt RD., Taipei, 106, Taiwan - ROC, cwkuo@ntu.edu.tw, Goker Aydin, Hyun-soo Ahn

We consider a retailer that faces two types of consumers price-takers and bargainers. The retailer's posted price serves as the take-it-or-leave-it price for price-takers, and it is the price from which bargainers negotiate down. We characterize the optimal posted price and the resulting negotiation outcome as a function of inventory and time. If negotiation is costly, the retailer prefers to implement it when the inventory level is high and the remaining selling season is short.

3 - Dynamic Pricing and Capacity Flexibility

Oben Ceryan, PhD candidate, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, oceryan@umich.edu, Ozge Sahin, Izak Duenyas

We study a joint mechanism of dynamic pricing and capacity flexibility to mitigate demand and supply mismatches. We consider a firm producing two products with correlated demands utilizing product dedicated and flexible resources and characterize the structure of the optimal production and pricing decisions. We investigate how the availability of a flexible resource influences the firm's pricing strategy and compare the economic benefits of a joint strategy over applying each tool separately.

4 - Joint Pricing and Production Decisions in an Assemble-to-order System

Sechan Oh, Stanford University, 380 Panama Way, Stanford, United States of America, scoh@stanford.edu, Karthik Sourirajan, Markus Ettl

We study a manufacturer who maximizes his profit over a finite horizon by making pricing, inventory replenishment, and component allocation decisions in an ATO system. We propose an implementable heuristic policy, which decouples the pricing, production decisions. We show that this policy performs well by simulating the profit under various environments. For the simulation test, we develop a simple, yet effective control variate, which reduces the variance of the estimator.

■ TD41

H-Sapphire L, Fourth Floor

Energy, Environment, and Sustainability

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Valerie Thomas, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, valerie.thomas@isye.gatech.edu

1 - Modeling Rail Impacts of Ethanol Shipping

Matt Kocoloski, Research Assistant, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, mkocolos@andrew.cmu.edu, W. Michael Griffin, H. Scott Matthews

Recent legislation requires domestic ethanol production to reach 36 billion gallons per year by 2022. Ethanol cannot be shipped through petroleum pipelines, so domestic ethanol shipping relies heavily on rail transportation. Here, we formulate rail freight shipments as a traffic assignment problem to estimate congestion resulting from ethanol shipments. We examine the impacts of distribution policies such as regional ethanol distribution to reduce rail congestion.

2 - Analysis of Cost, Energy and Environment in Packaging Solutions in International Supply Chain

Chen Zhou, Associate Professor, Georgia Institute of Technology, chen.zhou@isye.gatech.edu

The low cost in manufacturing propelled many firms to source their products off-shore. The off-shore manufacturing often reduces the cost but significantly prolongs the supply chain, and possibly leads to bigger environmental foot print. A case study was conducted to analyze the cost, the energy and eco-indicator of different packaging solutions for an automobile component. We extended the value stream map to analyze cost as well as energy consumption and the change in eco-indicators.

3 - Characteristics of Dynamic Decision Making in a Reverse Production System with Retailer Collection

Chanjoo Lee, PhD Candidate, Georgia Tech, H. Milton Stewart School of Industrial a, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, chanjoo.lee@gatech.edu, Matthew Realff, Jane Ammons

We present a continuous time differential game model that integrates pricing, production, and inventory decisions in a reverse production system with retailer collection. The OEM, the leader, is assumed to be motivated by potential economic values of returns and the retailer, the follower, by the incentives from the OEM. We identify the conditions under which both firms can increase profits and demands. The results show that firms can benefit from extensive product recovery activities.

4 - Computational Sustainability: An Interdisciplinary Approach

David Shmoys, Professor, Cornell University, 231 Rhodes Hall, Hoy Road, Ithaca, NY, 14853, United States of America, shmoys@cs.cornell.edu, Carla P. Gomes

Computational sustainability is the study of advanced computational models & methods for balancing environmental, economic, and societal needs for sustainable development. A recent NSF Expeditions grant brings together researchers in constraint optimization, dynamical systems, & machine learning, working with biologists and environmental scientists, to address these problems of unique scale, impact, complexity, & richness. Recent work on a metapopulation model for RCW will highlight these goals.

■ TD42

H-Sapphire P, Fourth Floor

Supply Chain Coordination I

Contributed Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - Coordinating a Channel in Presence of a Power Retailer

Xuemei Su, Assistant Professor, California State University Long Beach, 1250 Bellflower Blvd, Long Beach, CA, 90815, United States of America, xsu@csulb.edu, Samar Mukhopadhyay

We investigate a distribution system where a manufacturer sells through a number of retailers one of whom is dominant. The dominant retailer is the price leader and provides demand-stimulating services. We study two contract types namely, quantity discount and revenue sharing to examine which coordinates the channel and prevents the dominant retailer' reselling activities.

2 - Vertical Integration in Competing Supply Chains under Additive Stochastic Demand

Chongqi Wu, Assistant Professor, California State University, East Bay, 25800 Carlos Bee Boulevard, Hayward, CA, 94542, United States of America, chongqi.wu@csueastbay.edu, Hongwei Du, Xinjian Lu

This article studies integration/decentralization in competing supply chains under demand uncertainty. Two firms each produce a substitutable product and sell it through a decentralized or an integrated store, modeled as price-setting newsboy. We show that demand uncertainty may favor either integration or decentralization, depending on how demand uncertainty is characterized. Another important finding is that increase in horizontal competition does not always hurt manufacturers or retailers.

3 - A Dynamic Game of Supply Chain Coordination and Horizontal Competition

Pietro De Giovanni, PhD Candidate, Essec Business School, Avenue du Prefecture, Cergy Pontoise Paris, France, pietro.degiovanni@esse.fr, Fouad El Ouardighi

In this paper we consider two supply chains, each consisting of one manufacturer and one retailer. The supply chains compete for market demand both on price and advertising goodwill. The paper analyzes the players' optimal policies on inventory management, retail price, and advertising effort over time. We compare the possible outcomes under a wholesale price contract and a revenue sharing contract.

4 - Integrating Advance Demand Information in Supply Chain Contracts

Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu, Deng Ge

Advance demand information obtained from market survey mechanisms could be extremely valuable in optimizing production and inventory stocking decisions in a supply chain. This research investigates how this information can be integrated into typical contracts observed in supply chains and determines optimal decisions in a multi-period setting.

■ TD43

H-Room 400, Fourth Floor

Managing Commodity Risk in Supply Chain

Cluster: Supply Chain Models
Invited Session

Chair: Lingxiu Dong, Washington University in St. Louis, Olin Business School, 1 Brookings Drive, St. Louis, MO, 63130-4899, United States of America, dong@wustl.edu

Co-Chair: Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu

1 - Optimal Managerial Compensation and Financial Hedging in Commodity Procurement

Masha Shunko, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, mshunko@andrew.cmu.edu, Nicola Secomandi, Laurens Debo, Lin Nan

Consider a firm that uses a traded commodity as input to its production process and employs a risk-averse procurement manager. We study the interaction between the firm's financial hedging policy and the manager's procurement policy, the manager's optimal compensation structure, and the sensitivity of this structure to relevant parameters. We find that the optimal bonus for the manager is nonmonotone in various parameters of interest and only medium size firms benefit from financial hedging.

2 - Capacity Management for Agricultural Commodities

Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

This paper analyzes the capacity investment portfolio of a processor that uses a single input to produce multiple products in fixed proportions. The input and each output production require dedicated capacities. The main motivation comes from agribusiness where the input and some of the outputs are commodities and are traded on the spot markets. We investigate the effect of spot price variability, correlation among different end-products on the optimal capacity investment portfolio.

3 - Effect of Term Structure of Futures Price on Spot Procurement Policies

Ankur Goel, Case Western Reserve University, ankur.goel2@case.edu, Genaro Gutierrez

In this research, we explore the effect of term structure information of futures prices on the procurement policies from the spot market. We compare one-factor stochastic price model with a two-factor model to quantify the benefits of higher term structure model on operating policies. We conclude that for gasoline the two factor price model leads to substantial inventory cost savings. In addition, the frequent calibration of the price process has marginal benefit.

4 - Value of Processing Flexibility in Uncertain Input and Output Markets

Xiaole Wu, Ph.D. Candidate, Olin Business School, One Brookings Drive, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Lingxiu Dong, Panos Kouvelis

We consider a processing plant that takes in commodity inputs at various quality levels and processes them into intermediates that will be blended into various outputs. We focus on a specific type of processing flexibility that is used in the oil refinery industry, that is, converting low quality intermediates to high quality ones. We examine the value of such operational flexibility in an environment where input and output prices are volatile.

■ TD44

H-Room 402, Fourth Floor

Models of Service Management

Sponsor: Service Science
Sponsored Session

Chair: Ralph Badinelli, Virginia Tech, 1007 Pamplin Hall, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

1 - Dynamic Planning of Service Processes

Ralph Badinelli, Virginia Tech, 1007 Pamplin Hall, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

In this paper we extend previous model development to the case of multi-stage resource planning and process scheduling for services. We assume that the product-service system (PSS) requires the coordinated and adaptive participation of the service provider and the service recipient through a sequence of state-dependent processes (taktchronicity). Policies for resource commitment and dispatching are suggested and evaluated.

2 - Learning and Relearning Effects with Service Designs: An Empirical Analysis of Top Golf Courses

Gregory Heim, Assistant Professor, Texas A&M University, INFO Department Mays Business School, 320 Wehner Building 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu, Michael Ketzenberg

This paper examines learning and relearning effects in service environments where the service facility innovation and design activity is typically outsourced to external design firms. We explore whether the quality of service experiences changes over time in directions consistent with a learning curve effect. The findings illustrate how service outcomes can be negatively affected by service redesigns, and showing how learning effects can overcome such challenges over time.

3 - Impact of Productivity on Staffing Flexibility

Adelina Gnanlet, Assistant Professor, California State University at Fullerton, Department of Management, California State University at Fullerton, Fullerton, CA, United States of America, agnanlet@fullerton.edu, Wendell Gilland

We derive a closed form expression for the optimal amount of cross-training for nurses between two hospital units. We use a two-stage stochastic programming with recourse model that minimizes cost for general demand distributions. We analyze the impact of cross-training cost, demand variation and productivity on optimal nurse flexibility.

■ TD45

H-Room 410, Fouth Floor

Organization Theory I

Contributed Session

Chair: Masato Suzuki, Doctoral Student, Meiji University, 2028 Karuizawa, Kamagaya-shi, Chiba-ken, 273-0131, Japan, msuzuki0107@gmail.com

1 - Psychological Costs of Seeking Social Support: Scale Development and Factor Analysis

Vivien Lim, Associate Professor, NUS, Department of Management and Organizatio, Singapore, Singapore, bizlimv@nus.edu.sg, Xiuxi Zhao, Thompson Teo

When seeking social support, one may feel bad about self (intrapersonal cost) or worry about others judgment (interpersonal cost). Two studies were conducted to develop the scale of support seeking cost.Factor analysis reveals four dimensions under each type of cost:"negative thoughts","doubt of self worth","doubt of competence"and"doubt of self-reliance".The analysis of gender differences also reveals that men and women differ on two of the eight dimensions.

2 - Seeking Support Face-to-Face or Via Email? The Role of Support Seeking Cost

Xiuxi Zhao, Student, NUS, NUS Business School, Department of M&O, 1 Busines Link, BIZ2 Building, Level 4, Singapore, 117592, Singapore, zhao.xiuxi@nus.edu.sg, Thompson Teo, Vivien Lim

When seeking social support, one may feel bad about self (intrapersonal cost) or worry about others judgment (interpersonal cost). Items were developed to measure two types of cost. Survey data reveals that only the latter type of cost is significantly related to seekers preference of indirect support seeking (email) to direct f2f support seeking. Women have higher preference of seeking support through email over face-to-face.

3 - Condoning Violence Among College Students: The Influence of Musical Preference

Zara Boukary, MBA Student, Savannah State University, College of Business Administration, 3219 College St, Savannah, GA, 31404, United States of America, zboukary@student.savannahstate.edu, Dominique Jackson, Ulysses Brown

Using college students, this research examines the relationship between musical preference and condoning violence against men and women. Recently, celebrities have highlighted the social problem of domestic violence in American communities. Findings indicate that subjects who preferred rap music were more likely to condone violence against men and women.

4 - CEO Succession and Organizational Alignment: A Middle Management Perspective

Masato Suzuki, Doctoral Student, Meiji University, 2028 Karuizawa, Kamagaya-shi, Chiba-ken, 273-0131, Japan, msuzuki0107@gmail.com

This paper articulates the role of middle managers in strategic change that is triggered by a successor CEO. I develop an initial conceptualization of how middle managers intervene in a CEO succession-strategic change-outcomes process. The paper suggests a hidden underlining mechanism in strategic change

by shedding light on middle management perspectives as well as proposes that the research of the organizational alignment is an important research direction in CEO succession studies.

■ TD46

H-Room 411, Fourth Floor

Modularity in Services: Efficiency, Flexibility, and Innovativeness

Sponsor: Technology Management
Sponsored Session

Chair: Saara Pekkarinen, Project Leader, University of Oulu, P.O.Box 4600, Oulu, 90014, Finland, saara.pekkarinen@oulu.fi

1 - Modular Service Innovation: Managing Customer Knowledge in Creating Business Services

Minna Rollins, University of West Georgia, Richards College of Business, 1600 Maple St., Carrolton, GA, Carrolton, United States of America, mrollins@westga.edu, Saara Pekkarinen

This paper discusses the role and importance of customer knowledge in creating modular business services. Authors conceptualize how service firms can utilize their customer knowledge and manage customer interface in creating modular business services. This research integrates literature on modularity and service innovation from services marketing, service operation management, and knowledge management. In addition, authors discuss managerial implications for service firms.

2 - Key Modularity Dimensions of Service Innovations

Saara Pekkarinen, Project Leader, University of Oulu, P.O.Box 4600, Oulu, 90014, Finland, saara.pekkarinen@oulu.fi, Jouni Juntunen, Jari Juga

Paper explores modularity in creating logistic services and the patterns of organizational adjustments that might be required. Modularity dimensions 1) collaboration and coordination of functions, 2) integration and coordination of resources, and 3) interaction and communication are examined. This research builds on economics and management literature on modularity. Field data simulation and interviews result in theoretical and managerial implications.

3 - The Effect of Standardization and Agility on Logistics Costs

Vesa Autere, National Defense University, Department of Leadership and Military Pedagogy, Santahamina, Helsinki, Finland, vesa.autere@mil.fi, Jouni Juntunen, Mari Juntunen

This paper examines how standardization and agility affect the logistics costs of logistics service purchasers. A conceptual model is developed and tested with structural equation modeling (SEM) using empirical data from the Finnish Defense Forces, public sector and industrial companies. The results show that standardization promotes agility and agility advances cost reductions. Thus, standardization and agility are essential elements when the organization structure is modular.

4 - Soft and Hard Commitments: Two Supplement Methods to External Economies

Jouni Juntunen, University of Oulu, Faculty of Economics and Business Administration, P.O.Box 4600, Oulu, Finland, jouni.t.juntunen@oulu.fi, Mari Juntunen

The purpose is to study the relationship of soft (relationships and corporate brand image) and hard (relationship specific investments) commitments with external economies. A conceptual model is tested with SEM using empirical data from Finnish industrial companies. Response rate of survey was 22.5 % (N=235). The results show that corporate brand image and relationship-specific investments are a supplement component of external economies in modular organization structure.

■ TD47

H-Room 412, Fourth Floor

Globalization of Services

Cluster: Global Sourcing of Services
Invited Session

Chair: Sunil Mithas, Assistant Professor, University of Maryland, 4324 VMH U of Maryland, College Park, United States of America, smithas@rhsmith.umd.edu

1 - Human Resource Management Issues in the Global Delivery of Services

Jonathan Whitaker, Assistant Professor, University of Richmond, Robins School of Business, 1 Gateway Road, Richmond, VA, 23173, United States of America, jwhitaker@richmond.edu, Sunil Mithas

Rapid growth in the global production and delivery of services, including business process outsourcing (BPO), has enabled a large number of workers in emerging economies to pursue white-collar careers for the first time. This research identifies key HR issues for BPO employees in emerging economies, and conducts an empirical examination of these issues using survey data on Indian BPO employees.

2 - Quality Dimensions in IT Outsourcing Provision: An Empirical Analysis of Service Components

Ramanath Subramanyam, Assistant Professor, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth St., Champaign, IL, 61820, United States of America, rsubrama@illinois.edu, M.S. Krishnan, Wooje Cho

In this paper, we investigate drivers of customer satisfaction in IT outsourcing services. Using data collected on 185 outsourcing agreements from a leading global vendor of IT services, we analyze the effect of several quality drivers across different levels of overall satisfaction. We use the Quality-Function-Deployment framework to generate service supply implications for IT service providers.

3 - Internationalization Strategies of IT Service Vendors From Emerging Economies: The Case of China

Ning Su, Stern School of Business, New York University, 44 West 4th street, Rm. 8-185, New York, NY, 10012, United States of America, nsu@stern.nyu.edu, Natalia Levina

As China rapidly emerges as the new frontier of global IT outsourcing, the country's IT service industry undergoes a profound change: many leading vendors are strategically shifting their client bases from Japan to the U.S. and Europe. Through qualitative case studies of eleven major IT service firms in China, this paper elaborates the process by which China-based vendors transform their capabilities developed in domestic and Japanese markets to internationalize into the Western market.

4 - Does Training Improve Performance of Offshore IT Workers?

Nishtha Langer, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, nishtha_langer@isb.edu, Ravi Bapna, Amit Mehra, Ram Gopal, Alok Gupta

Firms in the IT services industry invest in employee training for productivity and competitive gains, but the link between training and employee performance is missing. We show this by using detailed archival training and employee level data from a leading IT services vendor. Using a fixed effects model, we find that even after controlling for employee experience, training improves performance, and that training and experience are substitutes; training at higher experience may be detrimental.

■ TD48

H-Sapphire Green Room, Fourth

Decision Making and Process Improvement in Complex Service Organizations

Cluster: Service Operations Management
Invited Session

Chair: Anita Tucker, Assistant Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu

1 - Diagnosing in Action: Virtuous and Vicious Cycles

Bradley Morrison, Brandeis International Business School, Waltham, MA, United States of America, bmorriso@brandeis.edu, Jenny Rudolph, John Carroll

Drawing on observation of doctors handling a medical emergency, we develop a system dynamics model of diagnostic problem solving that links interpretation and choice. Three insights emerge: (1) diagnostic problem solving includes acting, interpreting, and cultivating diagnoses; (2) dynamic interaction among these processes generates adaptive and failed modes problem solving; and (3) reinforcing feedback processes, usually considered dysfunctional, are essential for adaptive problem solving.

2 - Diversity in Experience and Team Familiarity: Evidence From Software Development

Bradley Staats, Assistant Professor, University of North Carolina, Kenan Flagler Business School, McColl Building, Chapel Hill, NC, United States of America, bstaats@gmail.com, Robert Huckman

Fluid teams with different sets of prior experience execute critical projects in organizations. Though building teams with diverse experience is needed, work on diversity in experience and performance fails to find a consistent effect. The issue is that diversity improves a team's functioning, but creates coordination challenges. We hypothesize that team familiarity helps teams leverage the benefits of diversity by alleviating coordination problems. We test this with software project data.

3 - Resource Allocation in Software Maintenance
Sriram Narayanan, Assistant Professor, Michigan State University, N357 Business College Complex, East Lansing, MI, 48824, United States of America, narayanan@bus.msu.edu, Sridhar Balasubramanian, Jay Swaminathan

We study allocation of engineering resources in software maintenance. We show that as software bugs stay in the system longer, the probability of successfully resolving them reduces. We use this insight to estimate engineering resources required to manage debugging effort. We explore cut off policy based on threshold time without finding a successful resolution. Our analysis shows that such policies minimally impact rate of successful resolution and reduce waiting times for incoming bugs.

4 - Do Professional Service Firms Learn From Outsourced Projects?
Ram Ganeshan, Professor, College of William and Mary, Mason School of Business, Williamsburg, VA, 23185, United States of America, ram.ganeshan@mason.wm.edu, Robert L. Hicks, Tonya Boone

Using data from a professional service firm, our research investigates if and how much, and why service firms learn from projects that are outsourced. We use learning-curve models to determine learning and forgetting rates; and provide insights into the enablers and barriers to learning with experience.

■ TD49

H-Room 300, Third Floor

Performance and Configurations of Production/Supply Systems for Multi-product Production Interruption Management

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Jeonghan Ko, University of Nebraska-Lincoln, Industrial and Management Systems Eng., Lincoln, NE, 68588, United States of America, jko2@unl.edu

Co-Chair: Hui Wang, PhD Candidate, University of Michigan, 2350 Hayward Rd, Ann Arbor, MI, 48109, United States of America, johnwang@umich.edu

1 - Multi-station Manufacturing System Design Considering Sequence Dependent Setups and Machine Types
Ehsan Nazarian, University of Nebraska-Lincoln, Industrial and Management Systems Eng., Lincoln, NE, 68588, United States of America, enazarian@unlnotes.unl.edu, Jeonghan Ko

We present optimal solutions for multi-station manufacturing system design considering manufacturing task recurrences and sequence-dependent setups. The objective is to minimize investment cost in multi-product production. Our optimization model determines the type of machines in each station considering task repetition. The model also optimizes task assignment to stations and task sequence within each station considering sequence dependent setup times and production batch sizes.

2 - Optimize Capacity, Simulate Capacity: Drain the Risk Out of Manufacturing Change
Astrid Tuin, Senior Application Engineer, LLamasoft, 206 South Fifth Avenue, Suite 400, Ann Arbor, MI, 48103, United States of America, astrid@llamasoft.com

Coca-Cola National Beverages Company wanted to reduce supply chain costs by increasing efficiency, while maintaining a flexible system that was responsive to changes in consumer needs. The main constraint on the system was limited production capacity. Optimal weekly transportation, inventory, and production plans were calculated; these were then refined using discrete event simulation. This gave CCNBC insight into service rates, inventory levels, and capacity issues at individual plants.

3 - Complexity Analysis of Assembly Supply Chains in the Presence of Product Variety
Hui Wang, PhD Candidate, University of Michigan, 2350 Hayward Rd, Ann Arbor, MI, 48109, United States of America, johnwang@umich.edu, Goker Aydin, S. Jack Hu

We propose a metric for the complexity of an assembly chain. This metric takes into account the supply chain configuration, product variety offered by the supply chain, and the demand split among the products. We investigate how this complexity metric relates to the cost of the supply chain and show that complexity and cost are equivalent under certain conditions. We illustrate how this complexity measure can be used as a proxy for cost in decision making.

4 - Capacities Expansion Problems in Manufacturing Network
Kun Huang, PhD Student, North Carolina State University, 111 Lampe Drive, 443 Danial Hall, Raleigh, NC, 27606, United States of America, khuang@ncsu.edu

The problems are based on distribution and assembly manufacturing network, which is a new kind of network introduced by Fang and Qi. Algorithm is developed to get maximum flow in manufacturing network. And after searching the most sensitive arc for output increase in the network, we provide an efficient procedure for capacities expansion plan with budget constraints.

■ TD50

H-Room 302, Third Floor

Managing Customers and Partners in Services

Sponsor: MSOM/ Service Management
Sponsored Session

Chair: Sameer Hasija, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Sameer.Hasija@insead.edu

1 - Buying From the Babbling Newsvendor: Availability Information and Cheap Talk
Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Achal Bassamboo

Provision of real-time information by a firm to its customers has become prevalent in recent years in both the service and retail sectors. In this paper, we study a retail operations model where customers are strategic in both their actions and in the way they interpret information, while the retailer is strategic in the way it provides information. This paper focuses on the ability (or the lack thereof) to credibly communicate unverifiable information.

2 - Service Outsourcing: Capacity, Quality and Correlated Costs
Fuqiang Zhang, Assistant Professor, Washington University in St. Louis, FZhang22@WUSTL.EDU, Justin Ren

This paper studies how to design service outsourcing contracts to ensure fast, quality services from an independent service provider. Both the service provider's capacity cost and quality cost are private information. We characterize the outsourcer's optimal contracts and investigate the performance of simpler, but suboptimal contracts.

3 - Contracting for Infrequent Restoration and Recovery of Mission-Critical Systems
Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu, Morris A. Cohen, Senthil Veeraraghavan, Serguei Netessine

Firms in industries such as aerospace and defense, high-tech manufacturing, and telecommunications rely on functioning mission-critical equipment. Using a model that builds upon the principal-agent framework, in this paper we show that designing a successful contract for outsourcing restoration services for such equipment creates nontrivial challenges that are unique to this environment due to the infrequent and random nature of equipment failures.

4 - Service Outsourcing Contract with Private Information on Uncertain Outcomes
Zhijian Cui, PhD Candidate, INSEAD, 40 Ave. Alfred Roll, Bois le Roi, 77590, France, Zhijian.CUI@insead.edu, Sameer Hasija

We focus on two important aspects of service outsourcing: vendor selection and relationship management under information asymmetry and uncertainty of outcomes. We study a business environment where payoffs depend on vendor effort and uncertain exogenous factors. The vendor exerts a non-observable effort and has more credible private priors on the exogenous uncertainty. We study outsourcing relationships that induce truth revelation and optimal effort by the vendor.

■ TD51

H-Room 303, Third Floor

Methods for Optimization Problems in Networks

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Tom Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, Department of DSES, 110 Eighth Street, Troy, NY, 12180, United States of America, sharkt@rpi.edu

1 - Integrated Restoration Planning and Scheduling for Critical Interdependent Infrastructure Systems
Burak Cavdaroglu, Research Assistant, Rensselaer Polytechnic Institute, Department of DSES, 110 Eighth Street, Troy, NY, 12180, United States of America, cavdab@rpi.edu, Tom Sharkey, William Al Wallace, John Mitchell

We consider the problem of restoring services to interdependent infrastructure systems. In this problem, we need to select the infrastructure components that will be installed to restore the services, assign the selected components to work groups, and then schedule the work groups to complete their tasks. We discuss

an integrated model to determine these decisions that relies on a network flow model of the operation of the infrastructure systems. Our model is then tested on real-world data.

2 - Exact Approaches for Solving Minimum Ratio Spanning Trees with Multiple-Ratios

Oleg Prokopyev, Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, prokopyev@engr.pitt.edu, Oleksii Ursulenko, Sergiy Butenko

We consider the sum-of-ratios version of the Minimum Ratio Spanning Tree Problem. Two MIP models are derived via MTZ constraints and the single commodity flow formulation. The suggested global optimization approach is based on the same general idea as the algorithm by Skiscim and Palocsay, but specifically addresses the difficulties arising when the number of ratios exceeds two.

3 - A Column Generation Approach for Joint Vehicle Assembly-routing Problems

Ahmed Ghoniem, University of Massachusetts Amherst, 121 Presidents Dr., Amherst, MA, 01003, United States of America, aghoniem@som.umass.edu, Hanif D. Sherali

We examine logistical systems where it is desirable to appropriately ascertain the joint composition of the sequences of vehicles that are to be physically connected along with determining their delivery routes over a large network of customers. We present a novel model and a column generation approach for this challenging class of joint vehicle assembly-routing problems. Computational experience is provided using realistic data from a case-study involving a major truck manufacturing company.

■ TD52

H-Room 304, Third Floor

Marketing and Operations Strategies in the Retail Industry

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Jing Zhou, Assistant Professor, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu

1 - On the Effect of Advertising Initiatives to Promote Healthy Food

Wenqing Zhang, PhD Candidate, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, wenqing.zhang@mail.mcgill.ca, Dan Zhang, Shanling Li

In response to increasing pressure to promote healthy eating, food companies have been adopting strategic initiatives that limit advertising expenses on traditional food products. This paper studies the effect of such initiatives on firm profit and consumer welfare in a joint advertising-pricing model that explicitly considers consumer food choice.

2 - The Effects of Gift Card Sales on the Optimal Order and Discount of Seasonal Products

Jing Zhou, Assistant Professor, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu, Moutaz Khouja, Jingming Pan

Gift cards have gained popularity during the holiday season. We study the retailer's inventory-pricing decisions of seasonal products in two periods. In the first period, the retailer determines the order quantity in dollars and consumers decide to buy either products or gift cards. In the second period, the retailer decides the post-holiday price to sell the remaining inventory. We investigate how gift cards change the retailer's ordering and pricing decisions and profitability.

3 - RFID Investment Analysis in the Retail Sector: A Hybrid Model

Narges Kasiri, Oklahoma State University, Hanner 101, Stillwater, OK, United States of America, narges.kasiri@okstate.edu, Ramesh Sharda

RFID adoption is on the agenda for many retailers. In the current economic situation, retail managers need to lower costs and stay competitive in the market more than at any other time. Adoption of RFID may be inevitable, but early adoption has a high cost, as well as many benefits. The question for managers is when the best time to implement this technology is. We combine real options technique with a simulation model to determine the best time to implement this technology in the retail sector.

4 - Channel Strategy with Third Party Logistics

Meng Lu, PhD Candidate, The Chinese University of HK, R615 ERB The CUHK, Shatin, Hong Kong - PRC, mlu@se.cuhk.edu.hk, Houmin Yan

A supply chain consists of a manufacturer, a 3PL and a retailer where 3PL provides emergency replenishment for the retailer. We develop a game model in investigating the dynamics and competitive behavior of the supply chain. Our studies reveal the possibility for the 3PL and the manufacturer's motivation of collaboration in creating a discrimination price, as well the collaboration between the 3PL and the retailer. Our model further demonstrates the supply chain dynamics with 3PL financing.

■ TD53

H-Room 305, Third Floor

Recent Results in Discrete Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Yanjun Li, Purdue University, 403 W. State Street, West Lafayette, United States of America, li14@purdue.edu

1 - Corner Polyhedra and Maximal Lattice-free Sets : A Geometric Approach to Cutting Plane Theory

Amitabh Basu, PhD Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15232, abasu1@andrew.cmu.edu, Gerard Cornuejols, Giacomo Zambelli, Michele Conforti

The Corner Polyhedron, introduced by Gomory in the early 60s, can be viewed as a unifying structure from which most of the known cutting planes in the literature can be derived. It has recently been observed that valid inequalities for the corner polyhedron have an intimate connection with maximal lattice-free convex sets. This connection provides a geometric way of analyzing these valid inequalities. This talk will review some recent theoretical results obtained by us in this area.

2 - Graph Labelings: Analysis of the Covering Problem

Milind Dawande, Professor, University of Texas at Dallas, 800 West Campbell Rd. SM30, School of Management, Richardson, TX, 75080, United States of America, milind@utdallas.edu, R Chandrasekaran, M Baysan

We discuss the covering of a graph by a feasible labeling. Given an undirected graph, two positive integers k and t, and an infinite alphabet, a feasible labeling is an assignment of a set of distinct labels to each vertex of the graph such that (i) the number of labels at a vertex is at most k and (ii) each label is used no more than a total of t times over all vertices. An edge is covered if there is at least one common label at its two end points. The graph is covered if each edge is covered.

3 - Disjunctive Cuts From Lattice-free Convex Sets

Andrea Qualizza, Ph.D. Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qualizza@cmu.edu, Egon Balas

We generate intersection cuts from lattice-free convex sets as lift-and-project cuts from multiple-term disjunctions. The disjunctive hull of a mixed-integer program at a fractional vertex v of its linear relaxation P is the convex hull of points in P satisfying all disjunctions that cut of v but no integer point. We examine the relationship between the disjunctive hull, the corner polyhedron and the integer hull.

■ TD54

H-Room 306A, Third Floor

Geometric Methods in Algorithms and Optimization

Sponsor: Optimization/Networks
Sponsored Session

Chair: James R. Lee, Professor, University of Washington, Department of Computer Science and Engin, Box 352350, Seattle, WA, 98195-2350, United States of America, jrl@cs.washington.edu

1 - Higher Eigenvalues of Graphs

Gregory N. Price, Massachusetts Institute of Technology, 32 Vassar St, Cambridge, MA, 02139, United States of America, price@MIT.EDU, Jonathan Kelner, James R. Lee, Shanghua Teng

We present a general method for proving upper bounds on the eigenvalues of the graph Laplacian. In particular, we show that for any k the k'th smallest Laplacian eigenvalue on a bounded-degree planar graph is O(k/n), which is tight. Similar bounds hold for bounded-genus and forbidden-minor graphs. Previously, such spectral bounds were only known for k=2, i.e. the Fiedler value. In addition our result yields a new, combinatorial proof of the celebrated result of Korevaar in differential geometry.

2 - Sparsest-cut on Surfaces
Anastasios Sidiropoulos, Postdoctoral Fellow, University of Toronto, 10 King's College Road, SF 2302A, Toronto, ON, M5S2R3, Canada, sidiropo@gmail.com, James R. Lee

We give an improved upper bound for max-flow/min-cut ratio of uniform multi-commodity flow on graphs of small genus. In particular, for graphs of genus k we show that this ratio is at most O(log k), improving upon the previously best known bound of O(k), due to Fakcharoenphol-Talwar, and Klein-Plotkin-Rao. Our main technical tool is a decomposition scheme for surfaces with parameters exponentially better in terms of the genus than previous results.

3 - How to Play Unique Games on Expanders
Yury Makarychev, TTI-Chicago, 6045 S. Kenwood Ave, Chicago, IL, 60637, United States of America, ymakarychev@gmail.com, Konstantin Makarychev

In this note we improve a recent result by Arora, Khot, Kolla, Steurer, Tulsiani, and Vishnoi on solving the Unique Games problem on expanders. Given a 1-epsilon satisfiable instance of Unique Games with the constraint graph G, our algorithm finds an assignments satisfying at least a 1- C epsilon/h fraction of all constraints if epsilon < c lambda where h is the edge expansion of G and lambda is the second smallest eigenvalue of the Laplacian of G.

4 - Breaking the Multicommodity Flow Barrier for Approximating Sparsest Cut
Jonah Sherman, UC Berkeley, Soda Hall, University of California, Berkeley, CA, 94720, United States of America, jsherman@EECS.berkeley.EDU

We present an algorithm for the sparsest cut problem that simultaneously achieves the better approximation factor of SDP/multicommodity-flow based algorithms and the subquadratic running time of single-commodity flow based algorithms. The idea is that we can turn Arora, Rao, and Vazirani's matching-chaining argument into an algorithm for finding good augmenting paths in a multicommodity flow network. Our analysis follows ARV's, making essential use of measure concentration on the sphere.

■ TD55

H-Room 306B, Third Floor

Computer Science-OR Applications to CS

Contributed Session

Chair: Larisa Shwartz, Scientist, IBM, T. J. Watson Research Center, 19 Skyline Rd, Hawthorne, NY, 10532, United States of America, lshwart@us.ibm.com

1 - 3D Information Visualization for Multiple Bin Sized Bin Packing Problem
Hande Cardak, CSUF, 1907 Deerpark Dr Apt 520, Fullerton, CA, 92831, United States of America, hande@csu.fullerton.edu, Tugce Gizem Martagan, Gurdal Ertek, Irem Savas

This study presents a software performing 3D visualization of multiple bin sized bin packing problems. The software is capable of visualizing the solution of any bin packing problem in a convenient and user friendly way. A smart bin coloring algorithm is developed and implemented. Visual representation of the solution will enable a better perception of results for academicians and practitioners.

2 - A New Grobner Basis Algorithm to Solve the Inference Problem in Statistical Database Security
Manuel Nunez, Associate Professor, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, mnunez@business.uconn.edu

A major issue in statistical database security is to provide accurate answers to aggregate queries while preventing inference of individual confidential values from the answers. Query restriction methods have been proposed to solve the inference problem for certain types of queries, but the problem is hard to solve for general non-linear queries dealing with numerical and categorical data. We present a new query restriction method based on Grobner basis theory to solve the inference problem.

3 - Application Effects of Concurrent Engineering in Computer Designing of Processes
Eric Dragan, CAD/CAM Engineer, SLOBODA, Ratka Mitrovic b.b., 32000 Cacak, 32000, Serbia-Montenegro, ericmdragan@yahoo.com, SVETISLAV MARKOVIC

Concurrent engineering represents fully integrated and parallel aproach to all the elements of designing. Our work connects development department and development of suitable processes alongwith the application of modern software tools for CAD,CAM,CAE and VE (Virtual Engineering). These parallely integrated systems make the system of Concurrent engineering increasingly efficient in comparison to systems of sequence design engineering.

4 - Cyberspace Villains: Piracy in Bits and Bytes
Janet Scott, Student, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, jscott7@alumni.savannahstate.edu, Ulysses Brown

The advent of the internet has transformed global business practices. However, in some instances these transformations are detrimental to specific industries, especially the music industry. Now music lovers can freely download songs and videos without paying artists and record companies. This paper examines the downloading behavior of research participants.

5 - Formalization of the SPC Service Delivery Process
Larisa Shwartz, Scientist, IBM, T. J. Watson Research Center, 19 Skyline Rd, Hawthorne, NY, 10532, United States of America, lshwart@us.ibm.com, Genady Grabarnik

A Service Provider Coalition is a group of providers that together supply a composed service and have group authority and responsibility to consumers of their services. Effective management of service delivery by SPC requires a cooperative service management information system as the communications medium across providers' organizations. We build probabilistic model of SPC delivery process where nodes represent services which we may treat as atomic services executed by a single provider.

■ TD56

H-Room 307, Third Floor

Algorithms and Applications for Compressed Sensing

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu

1 - An Alternating Direction Augmented Lagrangian Framework for Convex Semidefinite Programming
Shiqian Ma, Columbia University, 500 W. 120TH ST, Mudd Building, RM 313, New York, NY, 10027, United States of America, sm2756@columbia.edu, Donald Goldfarb, Zaiwen Wen, Katya Scheinberg

We present an alternating direction augmented Lagrangian framework for convex semidefinite programming problems. The convergence of the presented method is established. Numerical results for solving several types of sparse covariance selection problems are reported.

2 - A First-order Penalty Method for Compressed Sensing
Necdet Aybat, IEOR Deptartment Columbia University, IEOR Department Rm. 313, SEAS, Columbia Uni., 500 West 120th St., New York, NY, 10027, United States of America, nsa2106@columbia.edu, Garud N. Iyengar

The proposed algorithm efficiently solves min |x|_1 st Ax=b. We do not require A*A = I. Hence, it can be used to recover compressed CT scans, A*A = I doesn't hold.At each iterate x_k the extent of suboptimality and infeasibility is bounded. For any e, algorithm computes x_sol that is e-feasible i.e. |Ax_sol-b|_2 < e and e-optimal, ||x_soll_1 - |x*|_1| < e, in O(1/e) time without tuning the parameters for the given e. It can be extended to solve the relaxed recovery min |x|_1 st. |Ax-b|_2 <= e.

3 - FPC_AS: A Fast Algorithm for Sparse Reconstruction Based on Shrinkage and Subspace Optimization
Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Wotao Yin, Donald Goldfarb, Yin Zhang

We describe a fast algorithm for sparse reconstruction. The algorithm is divided into two stages that are performed repeatedly. In the first stage, "shrinkage" yields an estimate of the subset of variables likely to be nonzero in an optimal solution. Subspace optimization are then used to recover the magnitude of the solution in the second phase. Our implementation of this method exhibits state-of-the-art performance both in terms of its speed and its ability to recover sparse signals.

4 - Gradient Methods for Non-smooth Optimization with Applications to L1-minimization
Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, Canada, zhaosong@sfu.ca, Yong Zhang

In this talk, we study gradient methods for a class of non-smooth optimization problems. Then we discuss the application of these methods to a few well-known L1-minimization problems arising in science and engineering such as compressed sensing. Some preliminary computational results are finally presented.

■ TD57

H-Room 308, Third Floor

RFID/Sensor Data in Healthcare Operations

Sponsor: Health Applications
Sponsored Session

Chair: Daiki Min, PhD Candidate, School of Industrial Engineering, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, dmin@purdue.edu

1 - Equipment Management with RFID in Healthcare
Nebil Buyurgan, University of Arkansas, 4107 Bell Engineering Bld., Fayetteville, AR, 72701, United States of America, nebilb@uark.edu

An analysis of portable equipment management in hospital environments is presented. Considering the significant amount of personnel time for equipment search, a simulation-based decision support tool is developed to analyze tracking activities for different equipment. In addition, the impact of RFID technology on the widely-adopted management models is also studied. Using the search time for an item as a performance measure, better and improvable system configurations are identified.

2 - A Markov Chain Model for Quantifying the Value of Information From an RFID Tracking System
Xiuli Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, xqu@ncat.edu, LaKausha Simpson, Paul Stanfied

This paper proposes a Markov chain model to capture the states of critical hospital equipment. A sensitivity analysis is conducted to assess the impact of demand, searching efficiency, and maintenance policy alongside the use of an active RFID-enabled equipment tracking system. Performance is assessed in terms of operational costs and lost-of-service costs. The key finding is that the performance is most sensitive to the presence of an RFID system.

3 - An Intelligent Infrastructure For Healthcare
Edmund W. Schuster, Research Engineer, Auto-ID Labs, MIT, 77 Massachusetts Av., 35-135A, Cambidge, MA, 02139, United States of America, edmund_w@mit.edu

The vision of the EPCglobal Network and RFID technology is to provide continual access to the identity, location, and the state of physical objects. While much of the focus of RFID technology has concentrated on supply chain management, there remain significant opportunities for implementing the EPCglobal network in healthcare. This talk concentrates on RFID applications along with corresponding mathematical models to improve healthcare efficiency.

4 - Fuzzy Logic-based Algorithms for Detecting RFID Tag in an Outpatient Eye Clinic
Daiki Min, Ph.D. Candidate, School of Industrial Engineering, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, dmin@purdue.edu, Yuehwern Yih

In this paper, fuzzy logic-based algorithms are proposed to accurately locate the RFID tag in an outpatient eye clinic when the RFID reader is unreliable. The proposed algorithms determine the presence or absence of the RFID tag by evaluating its possibility of presence and possibility of absence. The experiment results show that the proposed algorithms outperform the existing static smoothing methods.

■ TD58

H-Room 309, Third Floor

OutSourcing and Subcontracting Games

Cluster: Scheduling
Invited Session

Chair: George Vairaktarakis, Case Western Reserve University, Weatherhead School of Management, Department of Operations, Cleveland, OH, 44106, United States of America, gxv5@case.edu

1 - Cooperation and the On-time Processing of Outsourced Operations
Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu, Xiaoqiang Cai, George Vairaktarakis

Online booking systems for reserving third-party processing capacity are increasingly used by companies that engage in manufacturing outsourcing. The current practice allows the customers of a third-party to update initial bookings and even cooperate with other customers to achieve significant savings. In this paper, we analyze the coordination issues that arise in such a setting, and provide transfer payment schemes that promote full cooperation of the customers as well as the third-party.

2 - Coordination of Outsourced Operations Subject to Booking, Overtime, and Tardiness Penalties
Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Dept of Systems Eng & Eng Management, Hong Kong, Hong Kong - PRC, xqcai@se.cuhk.edu.hk, George Vairaktarakis

A group of manufacturers outsource jobs to a single third-party subject to booking, overtime, and tardiness costs. We propose a coordination model based on a cooperative game, which creates a win-win solution to all.

3 - Coordination of WIP Costs in Subcontracted Operations
George Vairaktarakis, Case Western Reserve University, Weatherhead School of Management, Department of Operations, Cleveland, OH, 44106, United States of America, gxv5@case.edu, Xiaoqiang Cai

Consider m players each subcontracting part of his operations to a single third-party, with the objective of minimizing his total flowtime. When the players book third-party capacity in a first-come-first-book order, the resulting schedule at the third-party is socially inefficient. We study cooperative games and incentive systems that make it more profitable for all players to coordinate towards the centralized optimum than their individual optimal strategy.

■ TD59

H-Room 310, Third Floor

Tutorial: Fractional Programming with Applications

Cluster: Tutorials
Invited Session

Chair: Siegfried Schaible, Chung-Yuan Christian University, No. 200, Chung Pei Road, Chung Li, Taiwan - ROC, schaible2008@gmail.com

Co-Chair: Ruey-Lin SheuProfessor, National Cheng Kung University, No. 1, University Road, Tainan, Taiwan - ROC, rsheu@mail.ncku.edu.tw

1 - Fractional Programming with Applications
Siegfried Schaible, Chung-Yuan Christian University, No. 200, Chung Pei Road, Chung Li, Taiwan - ROC, schaible2008@gmail.com, Ruey-Lin Sheu

In this session, we emphasize (1) the history of fractional programming and its relation to generalized convexity; (2) real world problems with a fractional structure; (3) algorithms and duality for solving fractional programs. Examples from the transportation sciences and wireless network planning will be mentioned. Different types of dualities for non-convex optimization are compared and a new unified solution method is proposed. We are treating both the single-ratio and multi-ratio case.

■ TD60

H-Room 311, Third Floor

Multivariate Polynomial Optimization: Theory and Algorithms

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Jiawang Nie, UCSD, 9500 Gilman Drive, La Jolla, CA, United States of America, njw@math.ucsd.edu

1 - Which Convex Sets are Expressible by Semidefinite Programming ?
J. William Helton, Professor, UCSD, 9500 Gilman Drive, La Jolla, United States of America, Helton@math.ucsd.edu, Jiawang Nie

There are three natural directions this problem can take. The first one is what convex sets can be represented by linear matrix inequality (LMI). The second direction is whether this can be done when the variables are matrices of arbitrary dimensions. The last one is what convex sets are LMI represented by adding auxiliary variables, which is also called semidefinite programming (SDP) representable.

2 - A Convex Polynomial that is Not SOS-convex
Amir Ali Ahmadi, MIT, 195 Binney st., Apt. #4401, Cambridge, MA, 02142, United States of America, a_a_a@mit.edu, Pablo A. Parrilo

The algebraic notion of sos-convexity has recently been proposed as a sufficient condition for convexity of polynomials based on semidefinite programming. Motivated by its computational tractability, it has been speculated whether sos-convexity is also a necessary condition for convexity of polynomials. In this paper, we give a negative answer to this question by presenting an explicit example of a trivariate homogeneous polynomial of degree eight that is convex but not sos-convex.

3 - A New SDP Approach to the Max-cut Problem
Joao Gouveia, University of Washington, Department of Mathematics Box 354350, Seattle, WA, 98105, United States of America, jgouveia@u.washington.edu, Monique Laurent, Pablo A. Parrilo, Rekha R. Thomas

Using sums-of-squares techniques we develop a new hierarchy of SDP relaxations for the Max-Cut problem, solving an open question by Laszlo Lovasz.

4 - SDP Representation of Rational and Singular Convex Sets
Jiawang Nie, UCSD, 9500 Gilman Drive, La Jolla\, United States of America, njw@math.ucsd.edu, J. William Helton

A set is called SDP representable if it is expressible by some linear matrix inequality via lifting variables. First, we will present a general result: A set S defined by polynomial inequalities is SDP representable if its boundary pieces are nonsingular and positively curved. Second, we will present conditions for SDP representability when S is defined by multivariate rational polynomial functions or its boundary pieces have singularities. Specific examples will also be shown.

■ TD61

H-Room 312, Third Floor

Humanitarian Logistics

Contributed Session

Chair: Yan Yan, Northeastern University, Northeastern University,ShenYang,China, Shenyang, China, yanyan8262@126.com

1 - Stochastic Collaborative Humanitarian Relief Supply Chain Network Based on Multi-objective Criteria
Daniel Mota, Graduation Student, NCAT, 400 B Montrose Dr., Greensboro, NC, 27407, United States of America, danielmota.producao@gmail.com, Lauren Davis

Effectiveness is the primary goal in a humanitarian supply chain.Using Markov chain theory we developed a representation of the various sources of uncertainties present in a multi-supplier network during a disaster. A non-stationary model investigates the supply profile over the humanitarian relief life cycle and the impact on the network if backup supplier is used. Measured by a multi-criteria structure, we investigate the impact of the warehouses capacity on the victims assistance rate.

2 - A Supply Chain Emergency Dispatch Problem under Node Fails and Limited Resource
Yan Yan, Northeastern University, Northeastern University,ShenYang,China, Shenyang, China, yanyan8262@126.com, Liu Xiao

this paper addresses the emergency dispatch problem when one of the nodes fails. An optimal model is developed under constraints of limited resource to minimize the total cost. The simulation results indicate validity and practicability of the emergency dispatch solution using CPLEX.

■ TD62

H-Room 313, Third Floor

Teamwork and Communication

Contributed Session

Chair: Timothy L. Urban, Professor, The University of Tulsa, Operations Management, 800 South Tucker Drive, Tulsa, OK, 74104, United States of America, urbantl@utulsa.edu

1 - Sequential Analysis of Team Communication Patterns
Rebecca Perryman, Graduate Student, Texas A&M University, 2250 Dartmouth #412, College Station, TX, 77840, United States of America, rhaas@neo.tamu.edu, Sara McComb

Humans use mental models to understand their surroundings. In teams, the team members' mental models converge over time and become similar. The way this process unfolds, however, has not been examined. Herein, we use sequential analysis to examine team communication patterns. Results and implications are discussed.

2 - A Genetic Algorithm Approach to Optimizing Team Communication Processes
Deanna Kennedy, Doctoral Candidate, University of Massachusetts Amherst, Isenberg School of Management, 121 Presidents Drive, Amherst, MA, 01003, United States of America, dkennedy@som.umass.edu, Sara McComb

The search for team communication processes that achieve the best time and cost performances poses a multi-objective combinatorial optimization problem. In this paper, the problem was solved using a genetic algorithm approach that evolves strings of communication exchanges to find the optimal way in which the communication process should unfold among team members. Research and practitioner implications are discussed.

3 - Environmental Uncertainty and Teamwork: Effects of Changing Task Parameters on Team Outputs
Sara McComb, Associate Professor, Texas A&M University, Zachry Engineering Center, Room 237B, 3131 TAMU, College Station, TX, 77843, United States of America, mccomb@tamu.edu, Deanna Kennedy

Most teams face uncertain working conditions as they complete their assigned task. To investigate how teams respond to such uncertainty, we use longitudinal data, collected at the end of performance episodes, to examine the impact of changing task parameters on the teamwork processes of computer-mediated and face-to-face teams. Results and implications are discussed.

4 - The Social Power Networking Problem
Timothy L. Urban, Professor, The University of Tulsa, Operations Management, 800 South Tucker Drive, Tulsa, OK, 74104, United States of America, urbantl@utulsa.edu, Robert Russell

A social-networking problem is under consideration in which local professionals attend a function to meet other individuals in the business community. This combinatorial problem involves maximizing the minimum number of unique contacts made by each individual by assigning over 200 individuals, 10 at a table, for 5 rotations (hence, an individual can make up to 45 contacts). Bounds are developed and solution methodologies using constraint programming and mixed-integer programming are presented.

■ TD63

H-Room 314, Third Floor

Process Analysis in Health Care I

Contributed Session

Chair: Michael Samsa, Decision Support and Risk Management Group Leader, Argonne National Laboratory, 9700 South Cass Avenue, Building 900, Argonne, IL, 60439, United States of America, msamsa@anl.gov

1 - A Case Study of a Physical Examination Service in Taiwan
Wheyming Song, Tsing Hua University, 1001, Hsinchu, Taiwan - ROC, wheyming@ie.nthu.edu.tw

The objective of our project is to improve the efficiency of the Physical Examination (PE) service of a large hospital system in Taiwan. The efficiency is measured by patient wait time and physician utilization. A traditional approach would be to identify and evaluate an optimal solution. This paper focuses on an ideal solution rather than an optimization. We start with a simulation model, then discuss the optimal and ideal solutions based on the simulation model.

2 - Effect of Arrival Punctuality on the Interarrival Time of Queues that Schedule Appointments
Trent Larson, PhD Student, Walden University, 100 Revolution Drive, Leominster, United States of America, tlaelarson@verizon.net

What are the effects of arrival punctuality on queues that schedule arrivals to processes? Different interarrival time distributions are caused by the interaction between different types of arrival punctuality distributions and the time scheduled between appointments. The effects of punctuality distribution parameters are explored including: standard deviation, mean offset to appointment time, skewness, and punctuality distribution type.

3 - Detailed Time-in-motion Study of Three Diverse Mass Vaccination Clinic Operations
Michael Samsa, Decision Support and Risk Management Group Leader, Argonne National Laboratory, 9700 South Cass Avenue, Building 900, Argonne, IL, 60439, United States of America, msamsa@anl.gov, Matthew Berry

Argonne's Clinic Time-in-Motion Study Protocol employs synchronized hand-held electronic data collection devices to measure the start and finish time of each server's interaction with each patient. This protocol was applied in three diverse clinic settings and demonstrated a significant improvement in accuracy over methods recommended by CDC. Factors affecting patient throughput are statistical distributions of process steps are discussed. A model for optimizing clinic operations is shown.

■ TD64

H-Room 202A, Second Floor

Education II

Contributed Session

Chair: Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

1 - Antecedents of Faculty Evaluations: The Role of Grade Expectations

Shalonda Bradford, Lecturer, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, bradfors@savannahstate.edu, Ulysses Brown

This research examines the antecedents of student evaluations of faculty in several business courses. We used latent variable modeling to evaluate the hypotheses. Findings indicate that grade expectations influence student evaluation of faculty. We discuss implications, limitations, and future research suggestions.

2 - Enlightening College Students: Determinants of Advisor Satisfaction and Academic Support

Ulysses Brown, Assistant Professor of Management, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, brownu@savannahstate.edu, Joycelyn Finley-Hervey, Ruby Beale

This research examines the antecedents of academic support and advisor satisfaction among college students. Although not appealing to some professors, academic advising remains an important function of the Academy. Advising quality may determine whether students graduate in four years. Our findings reveal gender differences across the nomological network.

3 - Applied Capstone Course Design Elements: Pedagogical and Practical Considerations

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

The University of Dayton Operations Management Department has offered a highly successful capstone course in OM for seven years on 48 projects and 140 students. This talk discusses the practical and pedagocial considerations for offering a project course that applies O.R. skills to actual corporate clients. We discuss the benefits to the constituencies: faculty, students and client.

■ TD65

H-Room 202B, Second Floor

Joint Session WORMS/JFIG: Panel Discussion: What I Wish I Had Known: PhD Years and Beyond

Sponsor: Women in OR/MS & Junior Faculty Interest Group

Sponsored Session

Chair: Natalie Privett, PhD Candidate, Stanford University, Department of Management Science & Engin, Production & Operations Management, Stanford, CA, 94305, United States of America, nprivett@stanford.edu

Co-Chair: John Khawam, Stanford University, Stanford, CA, 94305, jkhawam@stanford.edu

1 - What I Wish I Had Known: PhD Years and Beyond

Moderator: Natalie Privett, PhD Candidate, Stanford University, Department of Management Science & Engin, Production & Operations Management, Stanford, CA, 94305, United States of America, nprivett@stanford.edu, Panelists: Candi Yano, Alexandra Newman, Elizabeth Durango-Cohen

Find out what you don't know you don't know in this multi-generational panel covering topics ranging from the Ph.D. job search to the future of OR/MS ; from the tenure process to life as an academic with kids. Feel free to bring your own questions, or just come and listen to sage advice and personal testimony.

■ TD66

H-Room 204A, Second Floor

Financial Engineering Models and Applications

Sponsor: MSOM/ iFORM

Sponsored Session

Chair: Farid AitSahlia, Risk Management and Financial Engineering Lab., University of Florida, Gainesville, United States of America, faitsahlia@gmail.com

1 - Optimal Operating Control and Dividend Distribution Policies

Rene Caldentey, Associate professor, New York University, rcaldent@stern.nyu.edu, Cristobal Correa

We consider a firm whose net earnings evolve according to a Brownian motion which is influenced by the firm's operating strategy. The firm has to decide on the optimal operating policy (controling the drift of the earnings process) as well as the leverage ratio and the distribution of dividends.

2 - Pricing and Hedging of Discretely Monitored Asian Options

Gudbjort Gylfadottir, Industrial and Systems Engineering, University of Florida, gudbjort@gmail.com, Farid AitSahlia

Asian options (with arithmetic average) are critical to control commodity prices and exchange rates fluctuations faced by corporations. We make use of quantile options to approximate the prices and hedge parameters of such options when the underlying is assumed to follow a Levy process.

3 - Estimating Distributions with Entropy Approach: Two Case Studies

Konstantin Kalinchenko, Doctorial Candidate, Risk Management and Financial Engineering lab, Department of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, kalinchenkok@gmail.com, Stan Uryasev

We are using entropy approach for calibrating probabilistic distributions. The first problem is related to estimating return distributions of a portfolio based on information from analysts. The second problem is from medical area where we are estimating the risk (probability) of cesarean section.

■ TD67

H-Room 204B, Second Floor

Data Envelopment Analysis: Methodology

Cluster: Data Envelopment Analysis

Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu

1 - Iu-Substitutability, Slacks and Data Envelopment Analysis

Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu, John Ruggiero

In DEA analysis remaining slacks have posed a problem in efficiency evaluation, because the nonparametric method does not assure a Koopmans efficient benchmark. We relax the free disposability assumption with the introduction of the Œμ-substitutability postulate imposing positive marginal rates of technical substitution. We then show that Debreu-Farrell efficiency is sufficient to quantify inefficiency under the minimum extrapolation postulate.

2 - Reconfiguration for Improving Efficiency of Branches

Hiroshi Morita, Osaka University, 2-1 Yamadaoka, Suita, Japan, morita@ist.osaka-u.ac.jp

Assume that the company has several branches, each of which has disjoint business territory. The managerial efficiency depends on the characteristics of territory. We consider the reconfiguration of branches to keep the efficiency of efficient branches, and at the same time, to improve the efficiency for inefficient branches.

3 - Three Stage DEA Models for Incorporating Exogenous Inputs
John Ruggiero, John.Ruggiero@notes.udayton.edu, Sarah Estelle, Andy Johnson

In this paper, we discuss three-stage models that control for exogenous, non-discretionary inputs in data envelopment analysis. In a recent journal article, Monte Carlo analysis was employed to compare and contrast alternative DEA models that measure efficiency in the presence of exogenous variables. The methodology for comparison was flawed, calling into question the presented results. We introduce new second-stage models and compare and contrast them with simulated data.

4 - An Essay on Pareto-Koopmans Efficiency in DEA
Kaoru Tone, Professor, National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677, Japan, KaoruTone@aol.com, Miki Tsutsui

Firstly, we discuss differences between Farrell and Pareto-Koopmans efficiency measures in DEA, and propose a method for discriminating them. Then, we extend the method to so-called 'epsilon based-measure (EBM).' The EBM can check the robustness of efficiency measure of DMUs regarding the virtual input or output weights.

■ TD68

H-Room 206, Second Floor

Sampling and Scenarios in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Stochastic Online Optimization of Hybrid Energy Systems
Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

We study the potential of applying systematic stochastic optimization techniques to managing hybrid energy systems such as solar-driven systems. We present a technique of computing and incorporating complete probability distribution of weather forecast uncertainty in a stochastic optimization framework. We demonstrate that significant economic benefits can be realized through the proposed developments.

2 - Multi-Stage Robust Lot-Sizing Problems
Yongpei Guan, Assistant Professor, Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu, Zhili Zhou

In this paper, we consider robust lot-sizing problem as an example to analyze multi-period robust integer optimization problems. Our objective is to provide a robust schedule for a multi-stage robust integer programming problem. Several cases are studied and corresponding algorithms are developed. Our preliminary study verifies the effectiveness of our approaches.

3 - Rate of Convergence in Scenario Approximation Using the Sparse Grid Method
Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, Michael Chen

Recently we have proposed the use of a sparse grid method for scenario generation in stochastic programming. We will present rate of convergence results for the sparse grid scenario generation method in stochatic programming. In particular, we show that for problems with expectation only in the objective and sufficient differentiability the rate of convergence is similar to that for integration problem.

■ TD69

H-Indigo A, Second Floor

Forecasting

Contributed Session

Chair: Tao Hong, Senior Engineer, Quanta Technology, 4020 Westchase Blvd, Suite 300, Raleigh, NC, 27607, United States of America, hongtao01@gmail.com

1 - The Demand for Money within a Supply and Demand Framework
Abul Jamal, Professor, Southeastern Louisiana University, Department of Management, Hammond, LA, 70402, United States of America, ajamal@selu.edu, Yu Hsing

The Demand for Money has been a subject of extensive analysis. Most researches however, estimate the demand function without considering the supply function as well. The purpose of this paper is to estimate the demand for money within a model where the supply function is also estimated simultaneously. The results should be useful to both macroeconomic researchers and policymakers.

2 - The Extended Diffusion Model to Forecast Demands of the New Multi-item Products
Jaehun Jung, PhD Student, Korea University, Anam-Dong Seongbuk-Gu, KUBS Main Building #516, Seoul, 136-701, Korea, Republic of, kafa7@korea.ac.kr, Daeki Kim

Demand forecast for new products is normally using the diffusion model; however, it is very difficult to forecast demands of new multi-item products. In this research, we extend the diffusion model with three additional parameters. We calibrate parameters for the products with historic data, or estimate parameters based on characteristics of products that have no historical information.

3 - Generating Random Walks for Time Series Forecasts through Monte Carlo Simulation
Samik Raychaudhuri, Sr. Member of Technical Staff, Oracle Inc., 4001 Discovery Drive, Suite 340, Boulder, CO, 80026, United States of America, samikr@gmail.com

Time series forecasting with simple methods is used heavily by academicians and practitioners alike for making decisions. Typically running a time series model on a historical data yields the base case forecasts. One might consider including the risks associated with this forecast, and consider a random walk model for simulating different scenarios. In this presentation, we discuss various options for performing Monte Carlo simulation with forecasts, and present some promising results.

4 - Electric Load Forecasting: Two Perspectives
Tao Hong, Senior Engineer, Quanta Technology, 4020 Westchase Blvd, Suite 300, Raleigh, NC, 27607, United States of America, hongtao01@gmail.com, Simon Hsiang, Pu Wang

Electric load forecasting is a well-known problem in the energy industry. Many methodologies could solve the problem theoretically; however, the solutions are quite different in practice. This paper presents various load forecasting problems and their solutions, to illustrate the difference between normative and positive perspectives.

Wednesday, 8:00am - 9:30am

■ WA01

C-Room 21, Upper Level

DA in Oil & Gas I

Sponsor: Decision Analysis
Sponsored Session

Chair: Steve Begg, Professor, University of Adelaide, Australian School of Petroleum, Santos Building, Adelaide, SA, 5066, Australia, steve.begg@adelaide.edu.au

Co-Chair: Reidar Bratvold, University of Stavanger, Department of Petroleum Engineering, Stavanger, 4036, Norway, reidar.bratvold@uis.no

1 - The Performance and Drivers of E&P Projects

Mary Ellen Yarossi, IPA Institute, myarossi@ipaglobal.com

This paper will present the results of analysis of over 1,000 E&P projects executed around. The research, based on detailed quantitative data has identifies key practices that drive the project outcomes. The relationship of these practices, in particular the quality of definition at the time the decision to fund the investment is made, an understanding of the project risks, and resources decisions made early in the investment cycle, to project outcomes will be shared. Recent industry trends in both outcomes and practices related to capital effectiveness will be discussed.

2 - How Decisions From the Appraise and Concept Selection Phase Drive Asset Outcomes Five Years Later

Paul Barshop, Chief Operating Officer, Independent Project Analysis (IPA), 44426 Atwater Drive, Ashburn, VA, 20147, pbarshop@ipaglobal.com

E&P asset development activities are completed by subsurface, drilling, and facilities working in parallel. Though work is done independently, there is a high degree of interdependency between the functions. For example, the reservoir data developed by the subsurface group is used extensively by the facilities and drilling functions. Decisions made by the reservoir group on the appraisal and reservoir program have a lasting effect on those functions. There are numerous examples of how early decisions can result in an asset with suboptimal performance. This paper will discuss functional interdependencies and explore methods for avoiding pitfalls.

3 - Implementing Decision Analysis: The Promise and the Practice - A 20 Year Retrospective

Frank Koch, Decision Analysis Practice Leader, Chevron, 1400 Smith Street, Houston, TX, 77002, fgko@chevron.com

Since 1989 decision analysis has become thoroughly integrated into the company's capital investment process. There are formal expectations and standard guidelines for using decision analysis. Major capital projects rigorously follow a structured dialogue decision process including framing, probabilistic economic modeling, interim peer reviews and lookbacks. Since 2000 we have done extensive training of decision makers to improve their ability to understand the analytic output and to better participate in the process. The presentation will summarize both how decision analysis has delivered on its promises and where it has fallen short.

■ WA02

C-Room 22, Upper Level

Facilitated Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Gilberto Montibeller, Associate Professor, London School of Economics, Houghton Street, WC2A 2AE, London, United Kingdom, G.Montibeller@lse.ac.uk

Co-Chair: L. Alberto Franco, Associate Professor, Warwick Business School, Univesity of Warwick, Coventry, CV4 7AL, United Kingdom, Alberto.Franco@wbs.ac.uk

1 - Slicing Potatoes Whilst Saving Energy: A Facilitated MCDA Process.

Ashley Carreras, Dr, De Montfort University, Bede Island, The Gateway, leicester, LE24DH, United Kingdom, ACarreras@dmu.ac.uk, Parmjit Kaur

This paper examines the outcomes of a three day facilitated event designed to choose projects that would leave to major cost savings in a multinational company. It will outline the key success factors in the development and use of value trees in a live workshop environment with a broad range of expertise and key stakeholders present

2 - Buying Health Care Services on Behalf of a Local Population: Bridging the Theory and Practice Divide

Alec Morton, Lecturer in Operational Research, London School of Economics, Houghton St, London, WC2A2AE, United Kingdom, A.Morton@lse.ac.uk, Gwyn Bevan, Mara Airoldi, Nikos Argyris

We present a number of cases in which we have used a multi-criteria portfolio approach with health planners in the UK and Canada. Our modelling draws on health economic concepts, but is a distinctively decision analytic approach in its emphasis on helping decision makers visualise the options space, integrate evidence and judgement, and decide how to use public funds to improve health and reduce health inequalities.

3 - Facilitated Decision Analysis

L. Alberto Franco, Associate Professor, Warwick Business School, Univesity of Warwick, Coventry, CV4 7AL, United Kingdom, Alberto.Franco@wbs.ac.uk, Gilberto Montibeller

In this paper we contrast the traditional way of applying decision analysis in organisations with a facilitated mode. In this latter mode the analyst conducts the whole intervention together with the client: from structuring and defining the nature of the problem situation of interest, to supporting the evaluation of priorities and development of plans for subsequent implementation. The review provides a general framework for facilitated decision analysis and its implications for practice.

■ WA03

C-Room 23A, Upper Level

Interactive Multiple Criteria Decision Making

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Jyrki Wallenius, Professor, Helsinki School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, Jyrki.Wallenius@hse.fi

1 - Bibliometric Analysis of Multiple Criteria Decision Making/Multiattribute Utility Theory

Hannele Wallenius, Professor and Department Head, Helsinki University of Technology, Otakaari 1, Espoo, 02150, Finland, hannele.wallenius@tkk.fi, Johanna Bragge, Pekka Korhonen, Jyrki Wallenius

Electronic databases allow for efficient retrieval and processing of bibliometric data, making enhanced literature reviews (research profiling) possible. We have conducted such a research profiling of Multiple Criteria Decision Making/Multiattribute Utility Theory using the ISI Web of Science. We report statistics regarding the development of our field. We find that our field has experienced exponential growth. It also has penetrated other neighboring disciplines, such as ICT and engineering.

2 - Importance of Criteria and Decision Weights Revisited

Anssi Oorni, Acting Professor, HSE, Runeberginkatu 22-24, Helsinki, 00100, Finland, anssi.oorni@hse.fi, Pekka Korhonen, Jyrki Wallenius

We seek to develop plausible explanations for announced importance of decision criteria. In an experiment, we have asked subjects to order a set of pairs of alternatives evaluated with two criteria based on their preferences. We have interpreted the subjects' choices using various formal decision models, both compensatory and noncompensatory. Our conclusion is that there does not exist a universal model to explain the choices. The choices are context dependent.

3 - Interactive Evolutionary Multi-objective Optimization for Quasi-concave Preference Functions

Jon Marquis, Senior Systems Engineer, Raytheon Company, 1151 E Hermans Rd, Tucson, AZ, 85756-9367, United States of America, jonemailbox@att.net, John Fowler, Esma Gel, Pekka Korhonen, Jyrki Wallenius, Murat Koksalan

We present a new approach to interactive multi-objective optimization that uses convex preference cones to rank solutions in a genetic algorithm. The technique sends a subset of the solutions to the decision maker (DM) for ranking, and uses the resulting information to form preference cones. The cones allow us to implicitly rank new solutions that the DM has not seen. We describe the genetic algorithm and discuss its performance on the multi-objective knapsack problem.

4 - Uses of Multi-criteria Decision Analysis in Group Decision Support

Raimo P. Hamalainen, Professor, Helsinki University of Technology, Systems Analysis Laboratory, Espoo, 02105, Finland, raimo@tkk.fi, Ahti Salo, Totti Konnola, Eeva Vilkkumaa, Juuso Liesiö

Multi-criteria decision analysis can serve several purposes in group decision making. We give a structured overview of alternative uses of MCDA methods for such purposes. We also propose new approaches that build on Robust Portfolio Modeling in synthesizing stakeholders' viewpoints. These approaches are illustrated by reporting an international foresight process through which the Joint Research Centre has sought to develop policy agendas that will be important for the European Union in 2025.

■ WA04

C-Room 23B, Upper Level

Mathematical Programming in Pattern Recognition and Machine Learning

Sponsor: Data Mining
Sponsored Session

Chair: Erhun Kundakcioglu, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Building 2, Houston, TX, 77204, United States of America, erhun@uh.edu

1 - Sequential Minimal Optimization for Relaxed Support Vector Machines

Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, seref@vt.edu

In this talk, we introduce a modification to the standard support vector machine (SVM) formulation, in which a restricted amount of unpenalized slack is provided to relax the support vectors. The Wolfe dual of this formulation can be solved efficiently via sequential minimal optimization (SMO). We focus on the adaptation of the SMO technique for the new dual formulation. We present comparative results against leading optimization software on multiple instance learning benchmark data sets.

2 - Solving the Order-Preserving Submatrix Problem via Integer Programming

Andrew Trapp, University of Pittsburgh, Pittsburgh, PA trapp.andrew@gmail.com, Oleg Prokopyev

In this paper we consider the Order Preserving Submatrix (OPSM) problem. This problem is known to be NP-hard. Although in recent years some heuristic methods have been presented to Ô¨Ånd OPSMs, they lack the guarantee of optimality. We present exact solution approaches based on linear mixed 0-1 programming formulations, and develop algorithmic enhancements to aid in solvability. Encouraging computational results are reported both for synthetic and real biological data.

3 - Nonlinear Data-driven Model to Predict Protein Abundance Using Stochastic Gradient Boosted Trees

Wandaliz Torres Garcia, PhD Student, Arizona State University, P.O. Box 875906, Tempe, 85287-5906, United States of America, wandaliz@asu.edu, George Runger

A nonlinear data-driven model to predict abundance for undetected proteins using two independent datasets of transcriptomic and proteomic data collected from bacteria is presented. We use Stochastic Gradient Boosted Trees to uncover relationships between gene expression and protein abundance. The model was validated using biological information of operons, regulons and pathways. The protein abundance values within most of these groups are indeed less dispersed than random groups of proteins.

4 - An Exact Algorithm for Multiple Instance Regression

Erhun Kundakcioglu, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Building 2, Houston, TX, 77204, United States of America, erhun@uh.edu, Panos Pardalos, Mike Sepehr Nasseri

In this study, support vector regression is considered within the multiple instance learning context, where data is composed of bags of instances. This setting is particularly useful when there is ambiguity in the data set, thus a selection process among bags of alternatives is necessary. A branch and bound algorithm is proposed for the MINLP problem that outperforms a commercial solver in terms of the best integer solution and optimality gap in a majority of breast cancer prognosis data sets.

■ WA05

C-Room 23C, Upper Level

High Definition Metrology Based Manufacturing Process Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Hui Wang, Research Fellow, University of Michigan, 2350 Hayward St., Ann Arbor, MI, 48109, United States of America, huiwz@umich.edu

1 - Sequential Sensing Strategy Based on Gaussian Process Model for Wafer Geometric Profile Estimation

Ran Jin, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, GA, 30332, United States of America, jinr@gatech.edu, Jianjun Shi

Wafer geometric profiles, such as thickness and flatness, are important for both quality inspection and diagnosis in a wafer manufacturing process. However, current sensing practice cannot achieve profile sensing for each wafer in production due to the temporal limitation using ADE WaferCheck. A sequential sensing strategy is developed to approximate wafer profiles by Gaussian process models. Sensing error is analyzed and compared in different sensing approaches based on the real measurements.

2 - Functional Process Variable Analysis for Process Control in Semiconductor Manufacturing

Xi Zhang, Ph.D., University of South Florida, Tampa FL 33620, United States of America, xzhang4@mail.usf.edu

We previously developed a nonlinear dynamics model to describe interactions among functional process variables (FPVs) for process condition monitoring. In this work, we extended our model to investigate interaction structure among three or more FPVs. The results show that the extracted patterns of interaction structure could aid to uncover the polishing mechanisms and provide more insights for condition monitoring and diagnosis.

3 - Morphing Based Multi-Stage Process Diagnosis Using High-Definition Metrology (HDM)

Liang Zhou, Research Assistant, University of Michigan, 2350 Hayward, Ann Arbor, MI, 48109, United States of America, zhl@umich.edu, Hui Wang, S. Jack Hu

Morphing is an image transformation methodology to study complex surface patterns as reflected from HDM data. Based on morphing, this work proposes a 2-step sequential method to diagnose spatial variation patterns in multistage manufacturing processes: a morphing-based registration to extract the geometric mapping relation among multiple operations, and a multistage designated component analysis to assess root causes by decomposing final features into variation patterns caused by each stage.

■ WA06

C-Room 24A, Upper Level

Acceptance Sampling and Control Charts

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Justin Chimka, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, United States of America, jchimka@uark.edu

1 - Bayesian Acceptance Sampling Plans in a Supply Chain with Endogenous Product Quality

Hong Wan, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, hwan@purdue.edu, Xiaowei Xu

This paper studies a firm that procures a product from a supplier. The firm conducts a variable acceptance sampling and pays the supplier only if the product batch passes the inspection. The inspection not only serves the purpose of preventing a bad batch from reaching customers but also offers the supplier an incentive to improve product quality. We identify the Nash equilibrium form and provide suffcient conditions that guarantee the existence of a pure strategy Nash equilibrium.

2 - A Simple New Demerit System

Qin Hong, University of Arkansas at Fayetteville, Fayetteville, AK, qxh002@uark.edu, Justin Chimka

We present a new statistical quality control model of ordinal data, based on the binomial (n, p) distribution, and derive a general expression for the demerit chart's type I error rate. An application shows that the system is good for some combinations of n and p.

■ WA07

C-Room 24B, Upper Level

Condition Based Maintenance

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhigang Tian, Assistant Professor, Concordia University, 1515 Ste-Catherine St. West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca

1 - Remaining Life Prediction Using Neural Networks Considering Suspension Data

Zhigang Tian, Assistant Professor, Concordia University, 1515 Ste-Catherine St. West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca

Most reported neural networks (ANN) based remaining life prediction methods only utilize condition monitoring data from failure histories, and ignores data obtained from suspension histories, which contains useful information revealing the degradation of equipments. In this work, an ANN approach is proposed for remaining life prediction considering both failure histories and suspension histories. The proposed approach is validated using vibration monitoring data collected from pump bearings.

2 - Mining Diagnostic Data for Electronic Prognostics in Complex Testing Equipment

Tongdan Jin, Texas A&M International University, 5201 University Blvd, Laredo, TX, 78041, United States of America, tjin@tamiu.edu

Automatic Test Equipment usually is equipped with diagnostic tools to check the system functionality and performance for the current state. Physical variables include voltage, current, and temperature. However, these diagnostic tools do not explicitly provide prognostic information in terms of the system reliability. Our research aims to create a framework that can provide advanced information and evaluate the system health based on the limited diagnostic data.

3 - Risk-informed Decision Making for a Complex System Involving Asynchronous Degradation Processes

Haitao Liao, Assistant Professor, Nuclear Engineering Department, Industrial & Information Engineering Department, 211 Pasqua Building, The University of Tennessee, Knoxville, TN, 37996, United States of America, hliao4@utk.edu, Jian Sun

When making a risk-informed decision using living probabilistic safety assessment (LPSA), initiating event frequencies and basic event probabilities can be updated by taking into account changes in system configuration, environmental factors, and equipment degradation. In this research, a new methodology is proposed to make risk-informed decisions for a system involving multiple asynchronous degradation processes subject to periodical condition monitoring.

4 - Bayesian Analysis of Heavily Interval-censored Data From A Fleet of Repairable Systems

Loon Ching Tang, Professor, National University of Singapore, Singapore, isetlc@nus.edu.sg, Xiao Liu

We analyze real life data from a large fleet of similar repairable systems in which failure data for each system is scarce and heavily censored (both left and right). Three simple Bayesian approaches, namely, the naÔve Bayesian approach, the Bayesian estimation focusing on single system, and the Bayesian estimation based on the Dirichlet-Multinomial model are presented. The performance of these Bayesian approaches is compared via simulation.

5 - Acoustic Emission and Structural Health Monitoring of Wind Turbine's Rotating Components

Morteza Assadi, PhD, Postdoctoral Fellow, Industrial and Manufacturing Eng. Department, Wichita State University, 1845 Fairmount St., Wichita, KS, 67260, United States of America, mxassadi@wichita.edu, Janet Twomey, Haitao Liao, Seyed Ahmad Niknam

Global warming and climate changes together with new directions in government policies have brought back the emphasis on renewable energy researches. Among the sustainable resources of energy, the wind energy has a long record in applications and researches. In this presentation, we discuss the applicability of acoustic emission sensors in monitoring the health condition of bearings and improving the maintenance operation of wind turbines.

■ WA08

C-Room 24C, Upper Level

Nonparametric Statistics and Applied Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Changxuan Mao, Principal Member of Technical Staff, AT &T Labs-Research, 180 Park Ave, Florham Park, NJ, 07932, United States of America, cxmao@research.att.com

1 - Determining Relative Importance of Variables in Regression

Liqiang Ni, Associate Professor, University of Central Florida, Department of Statistics, Orlando, FL, 32816, United States of America, lni@mail.ucf.edu

We propose a multivariate least-squares-type objective function with adaptive shrinkage to identify most important predictors in regression. The solution path with varying shrinkage provides an overall picture of the predictors' contributions. Under mild conditions on the marginal distribution of the predictors, the proposed approach selects necessary variables consistently without restrictive model assumptions.

2 - Modeling Time Trend via Spline Confidence Band

Jing Wang, Assistant Professor, University of Illinois at Chicago, Department of Mathematics, Statistics, and Computer Science, Chicago, IL, 60607, United States of America, wangjing@math.uic.edu

Simultaneous confidence band is obtained for the trend function of time series with heteroscedastic alpha-mixing errors, based on constant and linear spline smoothing. Simulation study confirms that the bands have conservative coverage of the true trend function. Linear band has been constructed for the Leaf Area Index (LAI) data collected in East Africa, which has revealed that the trigonometric curve in Regional Atmospheric Model System (RAMS) is inadequate.

3 - Estimating a Customer's Wallet From the Observed Spending

Changxuan Mao, Principal Member of Technical Staff, AT &T Labs-Research, 180 Park Ave, Florham Park, NJ, 07932, United States of America, cxmao@research.att.com

We propose a model for the customer's wallet problem in which the expected wallet of a customer depends on the customer's covariates. The random wallet is not observable. The observed spending with a focal company is the wallet multiplied by the share of wallet that is independent of the wallet. The posterior of the wallet is considered. The empirical posterior median and empirical credible intervals can be used for the practical purpose.

4 - Storage Assignment Heuristics Based on Association Rule Mining for Reducing Order Picking Distance

Chia Ping Lin, PH.D. Student, National Taiwan University, College of Management Floor 9, No. 1, Sec. 4, Roosevelt Road, Taipei Taiwan, Taipei, 106, Taiwan - ROC, d95741004@ntu.edu.tw, Ming Huang Chiang, Mu Chen Chen

This paper proposes two heuristics of storage assignment based on association analysis. Greedy association heuristic maximizes the association between products allocated within an aisle. Class-based association heuristic incorporates the relationships between products with traditional class-based heuristic. The experimental results indicate that proposed heuristics can significantly reduce the order picking distance.

■ WA09

C-Room 25A, Upper Level

Decision and Learning for Stochastic Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Cathy Xia, Associate Professor, The Ohio State University, ISE, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu

1 - The Coordination of Pricing and Scheduling Decisions

Nicholas Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall.33@osu.edu, Zhi-Long Chen

We consider coordinated pricing and scheduling decisions in a make to order environment, to maximize net profit. We develop computationally efficient algorithms for three coordinated. We compare solutions from an uncoordinated approach, a partially coordinated approach using only general scheduling information, a simple heuristic approach for the coordinated problem, and the optimal algorithm for the coordinated problem. Benefits are significant even if decisions are only partly coordinated.

2 - Efficient Algorithms for Stochastic Linear and Mixed-Integer Programs with CVaR Constraints

Dharmashankar Subramanian, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Rte 134, Yorktown Heights, NY, 10598, United States of America, dharmash@us.ibm.com, Pu Huang

We study single-stage, stochastic linear and mixed-integer linear programs, where conditional value at risk (CVaR) appears as a risk measure in multiple constraints. We establish two polyhedral reformulations of CVaR constraints, both of which allow for efficient decomposition algorithms.

3 - Objective Operational Learning

Andrew Lim, Associate Professor, University of California (Berkeley), IEOR Department, 4177 Etcheverry Hall, University of California, Berkeley, CA, 94720-1777, United States of America, lim@ieor.berkeley.edu, Lian Yu, J. George Shanthikumar

It is well know that erroneous modeling can lead to severely suboptimal decisions if they are incorrect (e.g. the spiral down effect). We introduce a kernel based algorithm for combined learning and optimization that does not require strong assumptions about the relationship between order quantity and demand. We demonstrate promising empirical performance for small data sets under weak assumptions on the demand distribution.

4 - Continuous Learning of Multiple Hypotheses with Resource Constraints

Cathy Xia, Associate Professor, The Ohio State University, ISE, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Ankit Jain

We study the problem of efficient resource allocation to answer multiple independent queries in information systems such as sensor networks. Presence of continuous streams of data and dynamic environment requires a real time resource allocation mechanism to get information as quickly as possible. We use continuous time control to show for common inference models, the problem reduces to multiple arm bandit and a myopic policy is optimal. We discuss extension to belief networks.

■ WA10

C-Room 25B, Upper Level

Economic Risk Analysis

Contributed Session

Chair: Kash Barker, Lecturer, School of Industrial Engineering, University of Oklahoma, 202 West Boyd Street, Room 124, Norman, OK, 73072, United States of America, kashbarker@ou.edu

1 - Chinese Economy Prospect Under the Influence of the Sub-prime Crisis and Fiscal Stimulus Policy

Guangtao Guo, PhD Candidate, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, China, guoguangtao@gmail.com, Lei Meng

Chinese government has announced a 4 trillion yuan stimulus package to counter the Sub-prime crisis which has shocked Chinese economy seriously.Based on Chinese non-competitive input-occupancy-output table of 2002 and the national input-output table of 2005, this paper estimated the negative effect of the export decline and the positive effect of the 4 trillion yuan investments on Chinese economy. In the end, prediction of Chinese economic trend and corresponding policy suggestions are given.

2 - Structural Interdependency and Sector Prioritization Using the Inoperability Input-Output Model

Jeesang Jung, University of Virginia, 108 Ridgemont Drive, Louisa, VA, 23093, United States of America, bok_snoopy@yahoo.com

In the real world, the economy keeps change over time due to several reasons. For a better risk preparedness, it requires timely analysis of economic inoperability structure. In this study, `economic inoperability structure analysis (EISA)' is developed for identifying critically important inoperability interdependencies with a graphical representation of interdependencies. Theory and applicability of EISA is tested for the United States economy between 1998 and 2007.

3 - A Risk-based Approach for Identifying Key Economic and Infrastructure Sectors

Kash Barker, Lecturer, School of Industrial Engineering, University of Oklahoma, 202 West Boyd Street, Room 124, Norman, OK, 73072, United States of America, kashbarker@ou.edu

In this work, an input-output approach and an inventory model are integrated to measure the benefits of inventory as a preparedness strategy among interdependent economic and infrastructure sectors. In particular, approaches are developed for identifying key sectors that are most benefited and that provide the most benefit when their inoperability, or the inoperability of other interdependent sectors, is delayed or reduced following a disruptive event.

■ WA11

C-Room 25C, Upper Level

Tail Asymptotics in Queues

Cluster: Queueing Models

Invited Session

Chair: Hayriye Ayhan, Associate Professor, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States of America, hayhan@isye.gatech.edu

1 - Cyclic Queueing Networks with Subexponential Service Times and Finite Buffers

Jung-Kyung Kim, Graduate Student, Georgia Institute of Technology, 1041 State ST NW #32, Atlanta, GA, 30318, United States of America, jkkim@isye.gatech.edu, Hayriye Ayhan

We consider closed tandem queueing networks with finite buffers and blocking. We assume that at least one station has subexponential service time distribution. We analyze this system under communication blocking and manufacturing blocking rules. Our objective is to derive expressions for the tail asymptotics of transient and stationary cycle times and waiting times. Furthermore, we provide numerical examples to understand the convergence behavior of the tail asymptotics.

2 - Rare-event Simulation for Multidimensional Regularly Varying Random Walks

Jingchen Liu, Assistant Professor, Columbia University, 1255 Amsterdam Ave, Room 1030, New York, NY, 10027, United States of America, jcliu@stat.columbia.edu, Jose Blanchet

We consider the problem of efficient simulation of first passage time probabilities for a multidimensional random walk with regularly varying increments. We develop a state-dependent importance sampling estimator for this class of multidimensional problems. An important feature of our algorithm involves the interplay between large deviations for regularly varying processes and linear programming.

3 - Numerical Methods for Analyzing Queues Involving Heavy-tailed Distributions

John Shortle, George Mason University, 4400 University Dr., MSN 4A6, Fairfax, United States of America, jshortle@gmu.edu

In this talk, we compare various numerical procedures for analyzing queues with heavy-tailed distributions. The goal is to compute the CDF of a distribution such as the waiting time in queue. Of particular interest are regions of the CDF that are not far out enough in the tail for asymptotic approximations to be accurate.

4 - Switching On and Off the Full Capacity of an M/M/c Queue

Eugene Feinberg, Professor, Stony Brook University, Department of Applied Math & Statistics, Stony Brook University, Stony Brook, NY, 11794, United States of America, efeinberg@notes.cc.sunysb.edu, Xiaoxuan Zhang

Scalability of IT technologies and internet applications lead to queueing models with service costs independent on the number of customers receiving the service. We consider an M/M/c queue with holding, switching, and running costs and show the optimality of (n,N)-policies. Unlike control of classic M/G/1 queues, the lower threshold level n can be positive.

■ WA12

C-Room 26A, Upper Level

Computational Linear Programming

Sponsor: Computing Society

Sponsored Session

Chair: Nick Sahinidis, John E. Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, United States of America, sahinidis@cmu.edu

1 - On-The-Fly Generation of Complete Tableau Vectors From Partial Systems

Lou Hafer, Simon Frazer University, lou@cs.sfu.ca

The dylp simplex code implements a dynamic simplex algorithm. Dynamic simplex regularly modifies the active constraint system in an attempt to keep it as small as possible (i.e., only tight constraints and promising variables). In this environment, generating full simplex tableau vectors on demand presents some interesting challenges. This talk will examine what the algebra says, what it takes to implement the algebra, and what it costs.

2 - On the Perceptron Rescaling Algorithm

Tamas Terlaky, Professor, Chair, Lehigh University, Department ISE, H. Mohler Lab, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu, Julio Goez, Dan Li

The perceptron algorithm is not a polynomial time algorithm to solve linear inequality systems, as its complexity depends on r^{-2}, where r is the radius of the largest inscribed ball. However, as Dunagan and Vempala showed, combined

with an iterative re-scaling algorithms, with high probability the largest inscribed ball can be inflated sufficiently to reach polynomial solvability. Various properties and parallelizablity of the re-scaling phase is analyzed in this talk.

3 - The Computation and Distribution of Reduced Costs in Random Linear Programs

Joe Elble, University of Illinois, Industrial Engineering, Urbana, IL, joseph.elble@gmail.com, Nick Sahinidis

This paper reviews the fundamentals of pricing including partial, sectional, multiple, nested, normalized, Dantzig, Devex, and steepest-edge pricing. In addition, extensive computational results suggest why some pricing strategies may work better than others.

■ WA13

C-Room 26B, Upper Level

Large Scale Computational Optimization Theory and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Gino Lim, University of Houston, Department of Industrial Engr., E211 Engr. Bldg 2, Houston, TX, 77204, United States of America, ginolim@uh.edu

1 - A Novel Decision Making Approach for Large-scale Short-notice Evacuation Planning Problems

Gino Lim, University of Houston, Det. of Industrial Engr., E211 Engr. Bldg 2, Houston, TX, 77204, United States of America, ginolim@uh.edu, MohammadReza Baharnemati, Shabnam Zangeneh

We present an optimization problem for large-scale evacuation problems. The main objective is to maximize the total number of evacuees from danger areas that are projected be affected by any kind of natural disaster such as hurricanes. We present a heuristic algorithm for very large-scale evacuation problems. The algorithm provides an efficient evacuation plan that includes optimum evacuation route, flow, and schedule for every node in the evacuation areas.

2 - Facility Location and Relocation Problem with Demand Change under Uncertainty

Ayse Durukan Sonmez, University of Houston, Industrial Engineering Department, Houston, TX, 77204, United States of America, adurukan@uh.edu, Gino Lim

We propose a new method for solving facility location problem that considers future demand changes as well as uncertain number of future facilities. The objective is to minimize the sum of the current weighted distance and the expected future distance, given that the opening and closing costs of facilities are known. We present an integer formulation of the problem and some numerical results that compare the performance of our method against another method found in the literature.

■ WA14

C-Room 27A, Upper Level

Optimization Software at Sandia National Laboratories: PEBBL, PICO, and Related Tools

Sponsor: Computing Society
Sponsored Session

Chair: Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu

1 - The PEBBL Parallel Branch-and-Bound Library

Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu, Cynthia Phillips, William Hart

PEBBL is an abstract object-oriented branch-and-bound framework which forms the basis for the PICO MIP solver, and provides for highly scalable parallelism. We discuss recent enhancements to PEBBL and its application to problems arising in peptide docking and machine learning. These applications can make use of PEBBL's ability to fully enumerate near-optimal solutions.

2 - SUCASA: A Tool for Integer Programming Solver Customizations Using Natural Names

Cynthia Phillips, Distinguished member of technical staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov, William Hart, Vitus Leung, Alessio Carosi

We describe the implementation and use of SUCASA (Solver Utility for Customization with Automatic Symbol Access), a mechanism for generating (integer) linear programming solvers with transparent access to algebraic modeling constructs. SUCASA provides access to parameters, constraints, and variables from an AMPL model within a PICO-based IP solver, with no need to explicitly manage mapping. This allows rapid development of problem-specific incumbent heuristics and cutting planes.

3 - Mixed-Integer Programming Heuristics in the PICO Solver

Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States of America, jpwatson@sandia.gov, Jonathan Eckstein, Cynthia Phillips

We discuss the general framework for implementing mixed-integer heuristics in the PICO parallel solver. The framework provides for the coordination and tuning of various heuristics, in both serial and parallel execution modes. We will detail the various heuristics implemented within PICO, including a generalized feasibility pump algorithm. Computational results on the MIPLIB 2003 benchmark will be presented.

■ WA15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - FICO - Building Optimization Applications in Xpress

Gabriel Tavares, Senior Consultant, FICO, 200 Smith Ranch Road, San Rafael, CA, 94903, United States of America, gabrieltavares@fico.com

This tutorial will focus on developing and deploying complete optimization applications using the FICO Xpress Optimization Suite. Xpress can be used for modeling, solving, analyzing, and visualizing optimization problems, and integrating them seamlessly in business applications. During this tutorial we will explain how Xpress-Mosel, Xpress-IVE and Xpress-Application Developer can decrease development time for new optimization applications and enable you and your customers to make smarter decisions.

2 - Lumina Decision Systems - Analytica: What it does that Spreadsheets Can't

Surya Swamy,Decision Analyst, Lumina Decision Systems, Inc, surya@lumina.com

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

■ WA16

C-Room 28A, Upper Level

Joint Session Information Systems/Data Mining: Social Data Mining

Sponsor: Information Systems & Data Mining
Sponsored Session

Chair: Maytal Saar-Tsechansky, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, TX, 10012, United States of America, Maytal.Saar-Tsechansky@mccombs.utexas.edu

1 - Audience Selection for On-line Brand Advertising: Privacy-Friendly Social Network Targeting

Foster Provost, Professor, NYU & Media6degrees, New York, NY, 10012, United States of America, fprovost@stern.nyu.edu

This study designs and evaluates privacy-friendly methods for extracting quasi-social networks from browser behavior on user-generated content sites, for the purpose of finding good audiences for brand advertising (as opposed to direct marketing). We introduce methods for defining brand affinity based on extracting quasi-social networks from data on anonymous visitations to social networking pages. Audiences with high brand proximity indeed show substantially higher brand affinity.

2 - Co-evolution of Social and Affiliation Networks

Elena Zheleva, University of Maryland, Computer Science Department, College Park, MD, 20742, United States of America, elena@cs.umd.edu, Lise Getoor, Hossam Sharara

Recent studies on social network evolution propose generative models which capture the statistical properties of networks related only to node-to-node link formation. In our work, we address the problem of modeling social network generation which explains both link and group formation. We provide surprising insights into group formation based on observations in several large real-world networks, and we propose the first model which captures the co-evolution of social and affiliation networks.

3 - From Graph Topology to Prediciton: Link Prediction Based on Cycle Formation

Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, PA, 16802, United States of America, zanhuang@psu.edu

Link-structure based link prediction is closely related to a parallel and almost separate stream of research on topological modeling of large-scale graphs. This paper represents initial efforts to explore the connection between link prediction and graph topology. We develop a link prediction algorithm based on a cycle formation model with parameters estimated from generalized clustering coefficient measures.

4 - Identifying Likely Adopters of Web Applications From User Generated Content and Social Networks

Shawndra Hill, Assistant Professor, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States of America, shawndra@wharton.upenn.edu

The aim of this study is to further understand the relationship between online social networks and the likelihood of product adoption, being an "influential" consumer and churning. We relate attributes derived from a user's online social network to rank web users by their likelihood to adopt a web application, pass it on to friends once they have adopted and uninstall the application. In addition, we present a summary of lessons learned from two social network web applications.

■ WA17

C-Room 28B, Upper Level

Digital Social Networks

Sponsor: e-Business
Sponsored Session

Chair: Bin Gu, Assistant Professor, University of Texas at Austin, 2100 Speedway B6500, Austin, United States of America, bin.gu@mccombs.utexas.edu

1 - Network Structure and Information Advantage: The Diversity, "Bandwidth Tradeoff"

Marshall Van Alstyne, Boston University, Boston, MA, mva@bu.edu

We examine the long held but empirically untested assumption that that diverse networks drive performance by providing access to novel information. We propose that a tradeoff between network diversity and channel bandwidth governs whether diverse networks deliver novel information and thus higher performance. As diversity increases, channel bandwidth decreases, creating countervailing pressures on novelty. We test our theory in a panel of email/accounting data for a group of knowledge workers.

2 - Social Influence and Social Norm in a Peer-to-Peer Music Sharing Network

Bin Gu, Assistant Professor, University of Texas at Austin, 2100 Speedway B6500, Austin, United States of America, bin.gu@mccombs.utexas.edu, Yun Huang, Wenjing (Wendy) Duan, Andrew Whinston

This paper analyzes the social dynamics between individuals and their environments using a panel data of 103,330 users in a P2P music sharing network. We have two findings: 1) individual contributions are positively influenced by their social environment; 2) individuals voluntarily enforce social norm on others to encourage contribution. Our results indicate that social influence and social norm plays a key role in moderating individual behavior in peer-to-peer networks.

3 - Value of Social Networks: A Large-Scale Study

Lynn Wu, MIT, 50 Memorial Drive, E53-314, Cambridge, MA, 02142, United States of America, linwu@MIT.EDU

Literature on social networks in organizations demonstrates that certain types of network topology are optimal. However, it suffers a deficit that focuses on small, static networks. Furthermore, a causal mechanism of how social network affect work performance has not been established. I mitigate this gap by mining the largest organizational social network ever collected and conducting a randomized experiment that can identify the causal mechanism of how social networks impact work performance.

4 - Social Networks and Investor Behavior in Online P2P Lending

Siva Viswanathan, Associate Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Mingfeng Lin

Drawing on economics and social psychology theories, we study the impact on social networks in the marketplace on individual decision-making under uncertainty. We gather data from a leading online peer-to-peer lending marketplace for business loans to test related hypotheses.

■ WA18

C-Room 28C, Upper Level

Wireless Networks 2

Sponsor: Telecommunications
Sponsored Session

Chair: Ivan Guardiola, Assistant Professor, Missouri S&T, 600 W. 14th St, Rolla, MO, 65409, United States of America, guardiolai@mst.edu

1 - Control Overhead Reduction and Through Movement Awareness Using GPS Information.

Ivan Guardiola, Assistant Professor, Missouri S&T, 600 W. 14th St, Rolla, MO, 65409, United States of America, guardiolai@mst.edu

This presentation highlights a new approach of mitigating the correlated effects of movement and multi-path fading on wireless ad hoc network communication. The use of GPS and velocity estimation methods during the route discovery phase result in more stable communication route within specific time interval. This leads to an increase of scalability as the control overhead is reduced. We present a new fundamental approach to movement based route selection.

2 - GPS Link Exclusion Comparison In TCP and UDP Based MANETS

Aaron Phillips, Texas Tech University, 2320 A 18th Street, Lubbock, TX, 79401, United States of America, aaron.phillips@ttu.edu, Timothy Matis

Work done using GPS location information to exclude possibly weak links in a route sending data packets has covered both UDP and TCP transport protocols. The question raised is whether such a mechanism might be transport-protocol specific. This research seeks to determine if the GPS link exclusion method benefits one transport protocol more than the other, or if this mechanism benefits the network independent of the transport protocol being used.

3 - Optimization Approaches to Wireless Sensor Network Design Problem

Hui Lin, Texas A&M University, 201 Zachary, College Station, United States of America, linhui@neo.tamu.edu, Halit Uster

We present an integrated analytical modeling framework for wireless sensor networks design incorporating topology control and routing decisions. The optimization model attempts to promote energy efficiency with the purpose of prolonging network lifetime. We develop efficient solution procedures based on energy distribution characteristics and decomposition approaches. We also present computational results on the performance of the solution methods for test problem instances.

4 - A Lagrangian Algorithm for the Capacitated Relay Network Design in Telecommunications

Panitan Kewcharoenwong, Texas A&M University, Industrial and System Engineering, College Station, TX, United States of America, panitan@neo.tamu.edu, Halit Uster

We consider a multi-commodity flow network where the commodities are relayed from origins to destinations through relay points. We provide a mathematical model to determine the relay point locations, arc selections, and data routing. We present a Lagrangian relaxation based algorithm for its solution and computational results illustrating the efficiency of the approach.

■ WA19

C-Room 28D, Upper Level

Freight Transportation Network Design

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Alan Erera, Associate Professor, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, alan.erera@isye.gatech.edu

1 - Subgraph Design for Time-Constrained Delivery

Barrett Thomas, University of Iowa, barrett-thomas@uiowa.edu, Ann Campbell, Hui Chen

We consider the problem of designing a delivery network in the face of delivery deadlines. We extend previous tree-structured work to the case of subgraphs. We prove that the problem is NP-hard and introduce several local-search heuristics for generating subgraphs. We identify special solution structure, introduce search neighborhoods to exploit the structure, and demonstrate their value.

2 - Network Design with End-to-End Service Requirements

Gang Li, The University of Texas at Austin, The University of Texas at Austin, Austin, TX, United States of America, gang.li@mail.utexas.edu, Prakash Mirchandani, Anant Balakrishnan

Given origin-to-destination transportation requirements, we consider the problem of designing a minimum cost network that can accommodate these

■ WA27

C-Room 31C, Upper Level

Advances in Simulation I

Contributed Session

Chair: Winfried Grassmann, Professor Emeritus, University of Saskatchewan, Department of Computer Science, 110 Science Place, Saskatoon, SK, S7N 5C9, Canada, grassman@cs.usask.ca

1 - Serial Nonrandomness in Random Number Generators

Vanlapha Santithammarak, PhD Student, Texas Tech University, Industrial Engineering Department, Lubbock, TX, 79409, United States of America, vanlapha.santithammarak@ttu.edu, Milton Smith

Randomness of currently available pseudo random number generators is almost taken as given. Routine empirical tests of several generators have indicated some problems with autocorrelation. These irregularities are examined; investigations are presented concerning the extent of nonrandomness and possible effects that might occur in simulation and Monte Carlo models.

2 - Omitting Meaningless Digits in Point Estimates: Leading-digit Rules

Wheyming Song, Professor, Tsing Hua Universtiy, 1001 Kung Fu Road, Hsinchu, Taiwan - ROC, wheyming_song@yahoo.com, Bruce Schmeiser, Mingchang Chih, Michael Chuang

Motivated by the question of which point-estimator digits to report in a statistical experiment, we study the probabilistic behavior of the digits as a function of the true performance measure and the point estimator's standard error. The easy-to-implement rule that reports the point estimate through the leading digit of the standard error has threshold (approximately) 0.117, which is not much larger than the one-in-ten probability of a uniformly distributed random digit being correct.

3 - Analysis of Sequential Stopping Rules for Confidence Interval Procedures

Dashi Singham, University of California, Berkeley, 4141 Etcheverry Hall, Department of IEOR, Berkeley, 94720, United States of America, dsingham@berkeley.edu, Lee Schruben

Sequential stopping rules applied to confidence interval procedures can result in a loss in coverage. This research introduces a method for estimating coverage functions analytically in order to evaluate the potential loss in coverage. Knowledge of coverage functions can help evaluate and compare confidence interval procedures. Analytical coverage functions can be used to show how sequential stopping rules affect the coverage these procedures.

4 - Comparison of OQN, CQN and SOQN via Simulation on CONWIP Systems

Li Sun, University of Louisville, Department of Industrial Engineering, Louiville, KY, United States of America, li.sun@louisville.edu, Sunderesh Heragu

We conduct a simulation comparison of open queuing network (OQN), closed queuing network (CQN), and semi-open queuing network (SOQN). We argue that SOQN is a more realistic model of a CONWIP system than OQN and CQN because it includes the time a job waits outside the system. The experimental results show that the performance measures among OQN, CQN and SOQN models are significantly different and demonstrate that SOQN is more realistic to represent a CONWIP system.

5 - Optimal Warm up Periods in Discrete Event Simulation

Winfried Grassmann, Professor Emeritus, University of Saskatchewan, Department of Computer Science, 110 Science Place, Saskatoon, SK, S7N 5C9, Canada, grassman@cs.usask.ca

In simulation, data collection often starts only after some delay, or warm up period. Frequently, no warm up is needed as will be shown. Otherwise, optimal warm up periods will be determined numerically.

■ WA28

H-Room 500, Fifth Floor

Optimal Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

Co-Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - Dynamic Pricing at the Special Service Industry by Convex Optimization

Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

We present a pricing mechanism under competition and blind market demand in special service industries where the customer behavior, demand-price relationship are quite unique. We build both stochastic constraints and worst case model for a control policy. All the models are solvable by convex optimization techniques. We conclude that the current pricing mechanism is an affine controller and yields to optimal solution.

2 - Optimal Markdown Pricing Strategy with Demand Learning

Steven Lippman, George W. Robbins Chair in Management, UCLA Anderson School of Management, Box 951481, Los Angeles, CA, 90095-1481, United States of America, slippman@anderson.ucla.edu, Dharma Kwon, Christopher S. Tang

When launching a new product, a firm has to set an initial price with incomplete information about demand. However, after observing the demand over a period of time, the firm might decide to mark down the price, especially when the Bayesian updated belief about demand is lower than originally anticipated. We consider the case in which the manufacturer makes three decisions: initial price, when to mark down the price, and the markdown price.

3 - Satisfying Objectives in a Supply Chain: Push, Pull, and Advance-Purchase Discount Contracts

Moutaz Khouja, Professor, University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, mjkhouja@uncc.edu, Xiuli He

We consider a supply chain with satisfying objectives. The retailer has two ordering opportunities. We study push, pull, and advance-purchase discount (APD) contracts. In a pull contact, the retailer takes no inventory responsibility; in a push contract, the retailer takes all inventory responsibility; in APD contracts, the retailer bears the risk on inventory ordered before the season. We obtain optimal production and ordering decisions and characterize a set of Pareto improvement contracts.

4 - Learning and Model Specification in Revenue Management of Substitutes

Le Li, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, leli@me.umn.edu, William L. Cooper

Consider a revenue manager, who controls availability of tickets for a set of substitutable flights using a parametric family of models and who must iteratively estimate model parameters. The talk will focus on the evolution of booking controls and parameter estimates over many selling seasons. In particular, it will address the long-run behavior of the controls when the parametric family of models is incorrectly specified and does not accurately account for consumer substitution.

■ WA29

H-Room 501, Fifth Floor

Decision Making in Electricity Markets

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Zhi Zhou, Rensselaer Polytechnic Institute, CII 5015, 110, 8th Street, Troy, NY, 12180, United States of America, zhouz@rpi.edu

1 - Gaming Based Reserve Price Cap Analysis

Jinye Zhao, JZhao@iso-ne.com, Beverley Brereton, Marc Montalvo

A resource can exercise market power in the joint energy and reserve markets, and result in higher energy and reserve prices. A Stackelberg game is utilized to analyze the short-term impact of the reserve price cap on market power mitigation. It is shown that no choice of reserve price cap completely eliminates the profit incentive for withholding reserve or marking up prices. However, the reserve price cap remains an effective tool to limit market power under the current market configuration.

2 - Bidding Behavior under Multi-objective Decision in Electricity Pool Markets

Zhi Zhou, Rensselaer Polytechnic Institute, CII 5015, 110, 8th Street, Troy, NY, 12180, United States of America, zhouz@rpi.edu, W.K. Victor Chan

In addition to profit maximization, the expected market share can be another objective that generation companies are trying to achieve. We apply an online hill climbing with adjustment learning algorithm to generator agents to guide them to bid strategically to reach their expected market share and maximize their profits. We simulate and analyze the bidding behavior and market equilibria under both accurate (or genial) expected market share and inaccurate (or malicious) market share.

3 - Using Weather Forecasts to Make Electricity Market Decisions
Matt Davison, Professor, University of Western Ontario, Department of Statistical and Actuarial, mdavison@uwo.ca, Guangzhi Zhao

The unpredictable natural environment strongly influences the electricity market. The value of an environmental prediction to energy market participants depends on how the forecast is used. Our case study estimates the value to a hydroelectricity producer of a perfectly accurate forecast of a random water inflow process. The forecast allows the power producer to make better use of its limited water storage. This value is an upper bound for a realistic imperfect forecast value.

4 - Renewable Portfolio Standard: A Game-theoretic Analysis
Fuzhan Nasiri, Postdoctoral Associate, Yale University, Environmental Engineering Program, New Haven, CT, United States of America, fuzhan.nasiri@yale.edu, Georges Zaccour

This study proposes a game theoretic approach toward the analysis of renewable portfolio standard policy (RPS), as one of the main driving forces behind the renewable electricity generation. The peculiar attribute of an RPS system, in tracking the compliance of electricity producers with a collective target for renewables, resembles a coupled constraint game. We present the RPS system through a game theoretic model accompanied by a case study and the analysis of the equilibrium.

■ WA30

H-Room 502, Fifth Floor

Energy II

Contributed Session

Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - An Empirical Examination of the Relation between Oil Prices and Exchange Rate
Andre Salles, Associate Professor, Federal University of Rio de Janeiro, Av. Ataulfo de Paiva, 348 ap. 501-Leblon, Rio de Janeiro, 22440033, Brazil, asalles@ind.ufrj.br

This work introduces a methodology, with a Bayesian approach, to study the returns of the oil prices. This methodology takes in consideration the violation of homoscedasticity and Gaussian distribution, in the construction of the models. Moreover this work examines the relationship between crude oil prices and exchange rate through a co-integration test. The data used in this study consists of the daily closing exchange rate, of US dollar to Euro, and oil prices, from June 2006 to March 2009.

2 - Economic Analysis of District Heating Energy Source Options: A Case Study in Vancouver Regional District
Saeed Ghafghazi, PhD Candidate, University of British Columbia, #2943- 2424 Main Mall, Vancouver, BC, V6T 1N4, Canada, saeed82@interchange.ubc.ca

Techno- economic performance of several energy options for a district heating system in the Vancouver area, British Columbia, is studied in this paper. It is shown that wood pellet heat producing technologies result in the less expensive heat energy followed by sewer heat recovery, geothermal and natural gas. Among the wood pellet technologies, cost of produced heat from the grate burner ranks better than powder and gasifier technologies, respectively.

3 - Electricity System Price and CO2 Emission Allowance System Price Modeling via Stochastic Programming
Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu, Niko Iliadis, Mario V.F. Pereira, Panos Pardalos

We discuss a stochastic program optimizing a hydro-thermal power system in the mid-term horizon taking into account stochastic fuel prices and stochastic inflow. The model seeks to minimize the generation cost of energy meeting the demand of the whole system while taking into account the CO2 emission allowances. The electricity system price and the CO2 emission allowance price are obtained via the dual multipliers of the optimal solution of the stochastic program.

■ WA31

H-Room 503, Fifth Floor

Pricing & Revenue Management: A Marketing Perspective

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Sri Devi DuvvuriAssistant Professor, University at Buffalo, Buffalo, NY, 14260, United States of America, sduvvuri@buffalo.edu

1 - Analysis of Brand Price Competition Using Measures of Brand Similarity
Gary Russell, University of Iowa, S252 PBB, Iowa City, IA, 52242, United States of America, gary-j-russell@uiowa.edu, Ann Petersen, Sri Devi Duvvuri, Suresh Divakar

Brand price competition is a well-researched area of marketing science. Significant progress in elasticity estimation has been made by constraining the pattern of cross-price elasticities using theories from consumer behavior and economics. Bucklin, Russell and Srinivasan (1998) [BRS] developed a theoretical relationship between brand switching patterns and cross-price elasticities. They showed that a matrix of cross-price elasticities is proportional to a simple transformation of a row conditional brand-switching matrix when the underlying consumer population makes purchases following a logit choice model. In this research, we build upon the BRS model by developing a theoretical framework for the specification of sales response models. We construct a corner solution choice model that allows for time variation in purchase quantity. By analytically aggregating this choice model over consumers, we are able to derive a sales model specification in which the brand-switching matrix again plays a key role. We apply the BRS theory to the analysis of brand price competition in the soft drink category. Using store-level data, we develop a random coefficients sales response model that constrains the matrix of cross-price elasticities using brand-switching information. We demonstrate that the new methodology yields high quality estimates of cross-price effects (consistent with a priori notions of category market structure) without sacrificing the level of model fit. We also show how the resulting elasticity estimates can be used to develop optimal pricing in the category.

2 - Modeling Dependencies in Brand Choices Across Complementary Categories: Pricing Implications Complementary Categories: Pricing Implications
Seethu Seetharaman, Professor, Jones School of Management, Rice University, Houston, TX, 77252, United States of America, seethu@rice.edu, Chakravarthi Narasimhan, Yu Ma

Our proposed multi-category choice model accommodates cross-category dependencies that arise on account of three component effects: (1) complementarity due to the additional utility that a household derives from the joint purchase of brands in complementary categories (component 1), (2) marketing spillovers due to the effects of brands' prices in one category affecting the households' latent utilities for brands in the complementary category (component 2), (3) unobserved dependencies due to correlations in households' latent utilities for brands across categories (component 3). While similar cross-category dependencies have been previously estimated using category-level incidence outcomes, they have not been estimated using brand choice outcomes. Our study, for the first time, investigates cross-category dependencies in brand choices (while also allowing for no purchase outcomes in each category). We estimate our proposed multi-category brand choice model using scanner panel data on cake mix and frosting categories. We obtain several interesting substantive insights on cross-category dependencies in household demand for cake mix and frosting.

3 - A Dynamic Structural Model of the Impact of Loyalty Programs on Customer Behavior
Yacheng Sun, Assistant Professor, Leeds School of Business, University of Colorado, Boulder, CO, 80309, United States of America, Yacheng.Sun @Colorado.edu, Vanitha Swaminathan, Praveen K Kopelle, Scott A. Neslin

We develop and estimate a dynamic structural model to determine the impact of frequency reward and customer tier components of a loyalty program on customer behavior. We provide an integrated analysis and measurement of a loyalty program incorporating customers' purchase and cash-in decisions, points pressure and rewarded behavior effects, heterogeneity, and forward-looking behavior We focus on the analysis of a hotel loyalty program, but in order to establish generalizability, we demonstrate these effects in the context of an airline's loyalty program as well. Using the hotel data, we find that a two-segment solution fits the data best both in estimation and validation samples, revealing a 'service-oriented' segment that highly values the customer tier component, and a 'price-oriented' segment that highly values the frequency reward aspects of the loyalty program. We empirically illustrate points pressure and rewarded behavior effects. Our research models the strength of response to frequency reward and customer tier program. In addition, we conducted simulations that vary aspects of the reward structure and measure the differential impact for both the price oriented and service-oriented segments and discuss policy implications regarding the setting of both frequency reward and customer tier requirements to maximize firm revenues.

■ WA32

H-Room 504, Fifth Level

Credit Risk Analysis

Contributed Session

Chair: Nuo Xu, Discover Financial Service, 1335 Johnson Dr Apt 1626, Buffalo Grove, IL, 60089, United States of America, arnold.xu@gmail.com

1 - Impact of Economic Capitalization on Scoring Decisions Within Consumer Credit

Kanshukan Rajaratnam, Student, University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States of America, kr5y@virginia.edu, Lu Gao, Peter Beling

A topic of interest in recent literature is the incorporation of forecasts of future economic conditions into acquisition decisions for scored retail credit portfolios. In these models, the score cutoff policy must be specified and implemented before the loan period but the performance of a cutoff policy is dependent on prevailing economic conditions during the loan period. We extend the model to include the level of economic capitalization as a decision prior to account performance.

2 - When the Slow Waltz of Correlation Accelerates: A Credit Risk Model with Short-time Contagion Effect

Zhan Li, Harvard University, 1 Oxford St 7th floor, Cambridge, MA, 02138, United States of America, jeff.zhanli@gmail.com, Jose Blanchet

Amid the economic crisis, it is quite interesting to study the credit risk models. Our aim is twofold: 1) present a model with contagion effects. The popular affine model is often criticized for the conditional independence between defaults. By introducing a common gamma factor, we improve the correlation profile between defaults. 2) establish large deviation results for the loss distribution and proposed a logarithmically efficient importance-sampling algorithm for credit risk models

3 - Default Intensities Implied By CDO Spreads: Inversion Formula and Model Calibration

Yu Hang Kan, Columbia University, 500 W.112th Street, New York, NY, 10027, United States of America, yk2246@columbia.edu, Romain Deguest, Rama Cont

We derive a closed-form formula for the local intensity, which is analogous to the so-called Dupire's formula for the local volatility. This formula allows us to transform the calibration of the local intensity into the calibration of the put option values written on the credit portfolio loss. Comparing our results to other calibration methods, we find that the local intensity surfaces are significantly different across algorithms.

4 - Assessing Securitization and Hedging Strategies for Management of Longevity Risk

Aparna Gupta, Assistant Professor, Lally School, RPI, 110 8th Street, Troy, NY, 12180, United States of America, guptaa@rpi.edu, Haiyuan Wang

Given the mortality risk of its customer-base, a provider of longevity risk-sensitive insurance products needs to develop a long-term risk profile of the cash-flow requirements of its products, and develop a hedge for the scenarios where the necessary payments may threaten solvency. We assess newly emerging hedging instruments, such as, mortality bonds, survivor swaps, longevity bonds, for their role in provider's risk management strategy in a shareholder maximization framework.

5 - Variable Selection in Credit Risk Modeling

Nuo Xu, Discover Financial Service, 1335 Johnson Dr Apt 1626, Buffalo Grove, IL, 60089, United States of America, arnold.xu@gmail.com

Employing mathematical models for risk control is a common practice in credit card industry thanks to the ready availability of data. The astronomical number of variables from various data sources posts the greatest challenge to modeling. This paper presents an innovative variable selection method, which is especially capable of discovering meaningful and actionable relationship embedded in the data. Its application in credit risk modeling is explained and demonstrated with an application.

■ WA33

H-Room 505, Fifth Floor

Design and Management of Global Supply Chains

Cluster: Economic Models in Operations Management

Invited Session

Chair: Srinagesh Gavirneni, Cornell University, sg337@cornell.edu

1 - The Impact of Buyback Price Commitment and Demand Uncertainty on Channel Conflicts

Lauren Xiaoyuan Lu, Assistant Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, Lauren_Lu@unc.edu, Gokce Esenduran, Jay Swaminathan

We study how a durable goods manufacturer can use different channel structures to mediate the conflicts between her two distribution channels: rental and sales. We develop a stylized model of three channel structures: separate, overlapping, and buyback. Under both deterministic and stochastic demand, while buyback mediates channel conflicts, it is the least profitable channel structure for the manufacturer.

2 - Production Planning under Supply and Demand Uncertainty with Downward Substitution

Tim Noparumpa, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, tnoparum@syr.edu, Scott Webster, Burak Kazaz

We study the production planning problem under random supply and demand for two products that are downward substitutable. We consider an agricultural firm that grows its own crop by leasing lands from other farmers, and also purchases from the open market. Weather conditions, diseases, and natural disasters influence not only the amount of crop yield, but also the quality of the crop yield. We provide the optimal decisions for the firm and the conditions that lead to unique optimal solutions.

3 - Global Facility Network Design with Transshipment and Responsive Pricing

Ping Su, SUNY New Paltz, One Hawk Drive, New Paltz, NY, 12561, United States of America, sup@newpaltz.edu, Panos Kouvelis, Lingxiu Dong

We study the facility network design problem for a global firm. The firm invests in capital intensive production facilities and produces outputs in the face of demand and exchange rate uncertainties, but can postpone localization and distribution until after uncertainties are resolved. We compare the optimal designs of two types of global firms: a newsvendor and a firm with responsive pricing, and highlight the impact of exchange rate and responsive pricing on the facility network decisions.

4 - Challenges in Managing Global Supply Networks

Vidyaranya Gargeya, Professor, The University of North Carolina at Greensboro, 479 Bryan Building, Greensboro, 27402-6165, vbgargey@uncg.edu

The last decade of the twentieth century has been characterized with the growth of global supply chains in a wide variety of industries. Using the multiple case study research methodology, this paper elaborates on the challenges associated with communication, cultural relationships, technology, production processes, supplier arrangements, transportation infrastructure, and tariff and duty structures in building global supply networks in the pharmaceutical, chemical, and automotive industries.

■ WA34

H-Room 520, Fifth Floor

"What Can a Model Do for Me?" Practical Public Health and Humanitarian Applications of OR

Cluster: OR/MS with Societal/ Humanitarian Impact

Invited Session

Chair: Nathaniel Hupert, Cornell University, Weill Cornell Medical College, 425 East 61st Street, New York, NY, 10021, United States of America, nah2005@med.cornell.edu

1 - Modeling the Spread of Measles and Investigating the Effectiveness of Vaccination Strategies

Tuba Yilmaz, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, tuba.yilmaz@gatech.edu, Pinar Keskinocak, Julie Swann

We develop an agent-based simulation to model the spread of measles both geographically and over time. We then explore the effectiveness of different vaccination strategies in case of an outbreak in terms of target population, vaccination coverage, intervention length and vaccinating neighboring counties in a circular coverage area.

2 - Optimizing a Mass Influenza/Pneumococcal Vaccinatoin Clinic via Simulation

Michael Washington, Deputy Director, Preparedness Modeling Unit, CDC\NCEH-ATSDR/OD, 4770 Buford Hwy, NE, MS F-59, Chamblee, GA, 30341, United States of America, mtw4@cdc.gov

Mass vaccinations could be a big issue this fall. This presentation will discuss a simulation in which a mass influenza/pneumococcal vaccination clinic designed after a clinic operated by a local health department was optimized to server the largest number of clients possible in 17 hours. The optimized model was able to serve 2,000 additional clients with 2 less staff and bring in an additional 15 percent in revenue. However, results from the optimized model resulted in ethical questions.

3 - Conceptual Framework of a Regional Telemedicine Hub in Medical Emergency Response

Wei Xiong, Instructor in Public Health, Weill Cornell Medical College, 402 E. 67th St., New York, NY, 10065, United States of America, wmz2001@med.cornell.edu

Telemedicine (TM) permits medical services to be provided remotely through the use of electronic information and communications technologies. In this study, we describe a simulation model of a conceptual framework of a regional Telemedicine Hub (TMH). We explore health-related outcomes associated with the proposed TMH model at both local and regional levels during the acute phase of hospital patient management in a typical earthquake scenario.

4 - Applied Dynamic Public Health Modeling: 2009 H1N1 Pandemic Vaccine Modeling

Bruce Lee, Assistant Professor of Medicine, Epidemiology, and Biomedical Informatics, University of Pittsburgh, 200 Meyran Ave., Suite 200, Pittsburgh PA 15213, United States of America, BYL1@pitt.edu

During the 2009 H1N1 influenza pandemic, as part of the Models of Infectious Disease Agent Study (MIDAS) H1N1 Vaccine Working Group, we developed and utilized large scale agent-based computer models to look at different aspects of vaccine distribution and administration. This was an example of public modeling during a rapidly evolving situation with time-sensitive decision making. This session will review our experience and important points to consider when modelers construct applied public health models and interface with various public health officials and policy makers.

■ WA35

H-Sapphire A, Fourth Floor

Models for Hospital Scheduling and Resource Management

Sponsor: Health Applications
Sponsored Session

Chair: John Osborn, Operations Manager, Mayo Clinic, 200 1st St SW, Mary Brigh 2-505, Rochester, MN, 55905, United States of America, Osborn.John@mayo.edu

1 - Time-based Heuristic Scheduling of Surgical Suites

John Osborn, Operations Manager, Mayo Clinic, 200 1st St SW, Mary Brigh 2-505, Rochester, MN, 55905, United States of America, Osborn.John@mayo.edu

Efficient allocation and utilization of surgical suites pose a challenge for most hospitals. Many models have been developed over time to optimize the assignment of operating rooms among surgeons and specialties. This paper reports the experience of a large academic medical center using a time-based heuristic for allocation of operating rooms, with comparison to prior scheduling schemes and experiences of other centers.

2 - Surgery Block Assignment in Multiple OR When the Starting Times are Fixed

Camilo Mancilla, PhD Student, ISE Department Lehigh Unviersity, Mohler Lab 200, Lehigh University, Bethlehem, PA, 18015, United States of America, cam306@lehigh.edu, Robert Storer

We study the daily problem of assigning surgery blocks to multiple operating rooms when surgery times are random variables. We discuss the structure of the model, and different solution methods. We analyze results using data from a local health care provider.

3 - Improved Cost and Quality of Care Through Patient Flow Management and Hospital Admission Control

Jonathan Helm, University of Michigan, 1205 Beal Ave, Ann Arbor, United States of America, jhelm@umich.edu, Mark Van Oyen

Hospital care services are frequently subject to unnecessary fluctuations in inpatient census and associated workload, leading to compromised quality of care, emergency patient diversions and elective patient cancellations, excessive Length of Stay and significant costs. This talk presents a model and decision support methods for scheduling and controlling inpatient admissions that consider patient flow through the complex network of downstream resources required to treat a hospital inpatient.

■ WA36

H-Sapphire B, Fourth Floor

Stochastic Models in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Oguzhan Alagoz, Assistant Professor, University of Wisconsin-Madison, Department of Industrial and Systems Eng, 1513 University Avenue, Madison, WI, 53706, United States of America, alagoz@engr.wisc.edu

1 - A Partially Observable Markov Decision Process Model for Prostate Cancer Screening

Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu, Brian Denton, Hari Balasubramanian, Brant Inman, Nilay Shah

Prostate cancer is the most common solid tumor in American men and its screening guidelines are highly debated. We report on a POMDP model for prostate cancer screening. The core states are the patient's health states and PSA values are the observations. Transition probabilities and rewards are estimated from a large regional data set and from the literature. We discuss structural properties of our model and we present the optimal policy for PSA screening frequency as a function of patient age.

2 - Optimizing Colonoscopy Screening for Colorectal Cancer Prevention & Surveillance Using A POMDP Model

Fatih Safa Erenay, University of Wisconsin Madison, 501 N Midvale Blvd Apt C, Madison, WI, 53705, United States of America, erenay@wisc.edu, Oguzhan Alagoz

Clinical guidelines suggest the use of colonoscopy screening for preventing colorectal cancer (CRC), the third deadliest cancer in US. We develop a finite-horizon POMDP model to determine pre-and post-CRC colonoscopy screening policies that maximize a patient's total expected quality adjusted life years according to the age, gender and CRC history. We derive the structural properties of the POMDP model and perform a numerical analysis based on clinical data and data from SEER database.

3 - Ambulance Diversion in Emergency Departments: The Role of Hospital Capacity

Sarang Deo, Assistant Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, s-deo@kellogg.northwestern.edu, Wuqin Lin, Gad Allon

Emergency department (ED) overcrowding and consequent ambulance diversion is one of the most pressing health care delivery problems in the US. In this paper we develop a two-stage queuing model to study the impact of structural factors such as the size and utilization of the hospital and the size of the ED on ambulance diversion status of the ED. We then test the key insights from our model using cross-sectional data from California and find moderate evidence for our results.

4 - Modeling the Transplant Waiting List: An Empirical Queuing Approach

Donald Lee, Yale University, 135 Prospect St, Box 208200, New Haven, CT, 06520, United States of America, donald.lee@yale.edu, Stefanos Zenios, Chris Lee

While the organ transplant waiting list can be modeled as a stochastic network, actual data suggest that the venerable assumptions of Poisson arrivals and exponential service times do a poor job in capturing transition dynamics. We introduce a method for inferring the actual arrival process and service rates from data. Instead of using finite patient classes to capture heterogeneity, we work at the finest resolution by predicting behavior based on covariates associated with each patient.

■ WA37

H-Sapphire C, Fourth Floor

Procurement and Supply Chain Management

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Brian Tomlin, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States of America, brian.tomlin@tuck.dartmouth.edu

Co-Chair: Yimin Wang, Assistant Professor, Arizona State University, Department of Supply Chain Mgmt, P.O. Box 874706, Tempe, AZ, 85287, United States of America, yimin_wang@asu.edu

1 - When Suppliers Have Learning Curves
John Khawam, Stanford University, Stanford, CA, 94305, jkhawam@stanford.edu, Hau Lee, Warren Hausman

We study a situation where multiple suppliers exhibit differing learning curves. A buyer's decision to purchase from a particular supplier will help that supplier lower costs in future periods. We present several related supplier sourcing models that solve for the optimal purchasing decisions under various supply chain configurations.

2 - Optimal Selling to Asymmetric Retailers
Dimitris Kostamis, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, dimitris_kostamis@unc.edu

We characterize the optimal contract menu for a manufacturer selling the same product to two firms engaged in imperfect competition. The retailers are asymmetric in that one is more attractive to the manufacturer than the other. We find that the manufacturer is sometimes better off offering a larger quantity and a larger discount to the weaker retailer. We also show how the optimal contract menu can be implemented using simple tariffs.

3 - Misalignment in the Timing of Seasonal Demand and Supply: The Landslide Effect
John Neale, Assistant Professor, Boston University, School of Management, 595 Commonwealth Ave., Boston, MA, 02215, United States of America, jneale@bu.edu, Sean Willems, James Beyl

Planning inventory and production in the face of seasonal demand can be challenging. Many companies experience a severe drop in inventory and service as they transition from a high season to a low season. Kraft Foods has termed this phenomenon the landslide effect. In this talk, we will present real examples of the landslide effect and explain its causes by comparing common industry practice to the correct inventory mathematics for nonstationary demand.

■ WA38

H-Sapphire D, Fourth Floor

Online Learning with Applications to Supply Chain and Revenue Management

Cluster: Inventory Management
Invited Session

Chair: Paat Rusmevichientong, Cornell University, 221 Rhodes Hall, Ithaca, NY, 148503, United States of America, paatrus@cornell.edu

1 - Approximate Solutions for the Capacity Allocation Problem - Performance and Computation
Thiam Lee, Columbia University, 500 West 120th St, New York, United States of America, thl2102@columbia.edu, Tim Huh, Retsef Levi

We define a new class of solutions for the canonical airline flight capacity allocation problem with independent demands and non-monotonic demand arrivals. We prove an approximation guarantee for their performance. We also show an algorithm that obtains from demand samples an instance from this class with high probability. Furthermore, the number of samples required to obtain, with a certain confidence probability, a solution of a desired performance level is polynomial in the parameters.

2 - Reducing Inventory Inaccuracy in the Supply Chain: Experiments with RFID Technology
John Aloysius, Associate Professor, University of Arkansas, WCOB 204, University of Arkansas, Fayetteville, AR, 72701, United States of America, JAloysius@walton.uark.edu, Sandeep Goyal, Bill Hardgrave

RFID technology has the potential to reduce inventory record inaccuracy which is a major hindrance to effective supply chain management. What are the potentials of case-level and item-level tagging? Is the technology equally effective across product categories? What characteristics of stores and products make them responsive to RFID? We present the results of field experiments using major retailers that investigate issues.

3 - Improved Inventory Policy Using Operational Statistics
Vivek Ramamurthy, UC Berkeley, Department of IEOR, Berkeley CA, United States of America, vivek_ramamurthy@berkeley.edu, J. George Shanthikumar, Max Shen

We consider the newsvendor inventory control problem with unknown demand parameters. We demonstrate that integrating parameter estimation and optimization leads to a greater a-priori expected proÔ¨Åt than the traditional method of separating the two steps. For demand having the Gamma distribution with unknown shape parameter, we propose ways to correct estimates and order quantities and study the effect on expected relative regret.

4 - Linearly Parameterized Bandits
Paat Rusmevichientong, Cornell University, 221 Rhodes Hall, Ithaca, NY, 148503, United States of America, paatrus@cornell.edu, John Tsitsiklis

Motivated by applications in e-commerce and revenue management, we consider multiarmed bandit problems involving a large (possibly infinite) collection of arms, in which the expected reward of each arm is a linear function of an unknown multivariate random variable. The objective is to choose a sequence of arms to minimize the cumulative regret and Bayes risk. We describe a policy whose performance is within a polylogarithmic factor from the optimal.

■ WA39

H-Sapphire E, Fourth Floor

New Models in Spare Parts Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Alan Scheller-Wolf, Associate Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu

1 - Inventory Rationing for a System with Heterogeneous Customer Classes
Paul Enders, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, penders@cmu.edu, Alan Scheller-Wolf, Ivo Adan, Geert-Jan van Houtum

Prioritizing demand streams is common in inventory management. In many settings (e.g.a central warehouse), some requests can be backordered while others are lost. A critical level (CL) policy reserves some inventory for the high priority class.We develop an efficient algorithm to find the optimal CL policy and compare the performance to the globally optimal policy. We find that although the CL policy performs (slightly) worse, it is almost insensitive to variations in the lead time distribution.

2 - Dispatching Policies for a Spare Parts Provisioning Problem
Pedram Sahba, University of Toronto, Mechanical and Industrial Engineering, Toronto, Canada, pedram@mie.utoronto.ca, Baris Balcioglu

We consider a centralized repair shop serving plants at different locations. When a machine fails at a plant, if a spare machine is available on stock, an immediate replacement takes place and the production capacity remains intact. Otherwise, the production capacity decreases till a machine is repaired at the repair shop and put back into service. We investigate the effects of repair shop pooling and the impact of certain dispatching policies with decentralized and centralized inventories.

3 - Multi-Item Two-Echelon Spare Parts Inventory Control with Batch Ordering in the Central Warehouse
Tarkan Tan, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Pav F7, Eindhoven, 5600 MB, Netherlands, t.tan@tue.nl, Engin Topan, Z. Pelin Bayindir

We consider a multi-item two-echelon inventory system in which the central warehouse operates under a (Q,R) policy and the local warehouses implement basestock policy. The objective is to find the policy parameters that minimize the system-wide inventory holding and ordering costs subject to an aggregate mean response time constraint at each facility. We propose different heuristics based on Lagrangean relaxation and sequential determination of policy parameters, and discuss their performances.

4 - An Inventory Model for Slow Moving Items Subject to Obsolescence
Cerag Pince, Erasmus Research Institute of Management, Burg. Ourlaan 50, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, pince@ese.eur.nl, Rommert Dekker, Hans Frenk

We considered single-location inventory system of a slow moving item where the Poisson demand rate drops to lower level at a known future time. Adaptation to the lower demand rate is achieved by reducing base stock level of the one-for-one policy in advance. Under discounted cost criterion, optimal base stock levels and optimal time for policy change were obtained numerically. We found that when obsolescence can be foreseen, early adaptation of base stock levels leads to important savings.

■ WA40

H-Sapphire H, Fourth Floor

Materials Coordination in Multi-Location Inventory Systems

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Geert-Jan van Houtum, Professor, Eindhoven University of Technology, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, G.J.v.Houtum@tm.tue.nl

Co-Chair: Kevin Shang, Duke University, The Fuqua School of Business, 1 Tower Drive, Durham, NC, 27708, khshang@duke.edu

1 - Cost-Sharing Contracts for Coordinating Semi-Centralized Global Production Networks
Fang Liu, Duke University, 1 Towerview Dr., Durham, United States of America, fl17@duke.edu, Jeannette Song

We study a global production network for a multinational company, comprising a home plant and a foreign branch. The foreign branch orders a key component from the home plant and incurs a high fixed order cost. The home plant is responsible to provide 100% fill rate at the expense of expediting. Each location follows a local (s, t) policy. We analyze the effect of cost-sharing contracts on supply chain performance.

2 - Multi-Item Multi-Echelon Inventory Systems with Random Yield
Ton de Kok, Full Professor, Technology University of Eindhoven, Department of Technology Management, P.O.Box 513, Eindhoven, 5600MB, Netherlands, a.g.d.kok@tue.nl

In this paper we consider general multi-item multi-echelon inventory systems. We propose a control policy that can handle random yield. The exact analysis of multi-item multi-echelon inventory systems with random yield is beyond our reach. Therefore we develop approximations based on the assumption that subsequent orders from a stockpoint constitute independent and identically distributed random variables derived from exogenous demand and the random yield process.

3 - Optimization of Echelon (S,T) Policies in Two-Echelon Distribution Systems with Fixed Costs
Kevin Shang, Duke University, The Fuqua School of Business, 1 Tower Drive, Durham, NC, 27708, khshang@duke.edu, Sean Zhou

We consider an inventory system with one warehouse and N non-identical retailers, who face independent Poisson demand. Each stage implements a periodic-review, echelon (S,T) policy, where S is the echelon base-stock level and T is the reorder interval. A fixed cost is incurred for each inventory reorder. We show how to obtain the optimal policy and provide a heuristic that generates a near-optimal solution by solving a series of single-stage problems.

4 - Multi-Location Inventory Models with Overflow Demand Streams
Geert-Jan van Houtum, Professor, Eindhoven University of Technology, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, G.J.v.Houtum@tm.tue.nl

We consider multi-location inventory models with Poisson demand streams and overflow of demands, which one may have because of the application of lateral transshipments or demand substitution. We discuss a series of applications for such models, and we present a general approach for approximate evaluation of a given inventory policy.

■ WA41

H-Sapphire L, Fourth Floor

Operations Research Applications for Elections

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Michael Fry, Associate Professor, University of Cincinnati, 532 Lindner Hall, Cincinnati, OH, 45221, United States of America, mike.fry@uc.edu

1 - A Retrospective Analysis of Predictions for the 2008 United States Presidential Election
Sheldon Jacobson, Professor, University of Illinois, Department of Computer Science, 201 N. Goodwin Avenue, Urbana, IL, 61801-2302, United States of America, shj@illinois.edu, Edward Sewell, Steven Rigdon, Wendy Cho

This presentation reviews the predictions reported using a Bayesian approach that incorporated the effect of third-party candidates and undecided voters for predicting the outcome of the 2008 Presidential Election, as reported on http://election08.cs.uiuc.edu. Several lessons learned are discussed that will be used in refining the predictions for the 2012 election.

2 - Using Integer Programming to Assess of the Viability of a 3rd Party Candidate in a U.S. Presidential Election
James Cochran, Associate Professor, Louisiana Tech University, College of Business, P. O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

We use the results of a conjoint analysis as parameter estimates in a maximal covering formulation to assess the viability of a 3rd party candidate by finding her/his optimal platform relative to platforms attributed by voters to major party candidates. We demonstrate this result on data collected for the 2004 election.

3 - Allocating DRE Voting Machines to Achieve Efficiency and Equity
Muer Yang, University of Cincinnati, 501 Lindner Hall, University of Cincinnati, Cincinnati, OH, 45221, United States of America, yangmr@email.uc.edu, David Kelton, Michael Fry

Providing equity to all voters has been noted as an important goal in elections. Equity refers to the belief that all voters should receive approximately equivalent wait time experiences so that no one particular group of voters is disadvantaged or disenfranchised. This paper provides a metric for equity, proposes and examines several policies for allocating direct-recording electronic voting machines by combining closed-form queueing models, simulation, and mixed integer programming.

■ WA42

H-Sapphire P, Fourth Floor

Supply Chain Coordination II

Contributed Session

Chair: Mahdi Zanddizari, University of Maryland, 4803 Drexel Rd., College Park, MD, United States of America, mzd@umd.edu

1 - Wholesale Price for Supply Chain Coordination via CVaR Minimization
Chuanxu Wang, Shanghai Maritime University, 1550 Pudong Avenue, Shanghai, China, cxwang@shmtu.edu.cn

The CVaR theory is considered to develop a model of supply chain coordination with a wholesale pricing policy. It can be shown from the paper that, with the increase of risk averting degree for supply chain individual members, the optimal order quantity and supply chain profit are decreasing; If supplier's (retailer's) risk averting degree increases, supplier has to increase (decrease) wholesale price to achieve supply chain coordination.

2 - Coordinating Inventory and Pricing Decisions in a Buyer-vendor System
Su Zhao, Texas A&M University, Departmentof Industrial & Systems Engineering, College Station, TX, United States of America, zhaos@tamu.edu, Sila Cetinkaya, Eylem Tekin

We study the joint pricing and inventory problem arising in the context of a buyer-vendor, e.g. distributor-manufacturer system. Demand for the product in a given period is a random variable which depends on the price. We study the optimal inventory-pricing policies, examine the sufficient conditions under which base-stock-list price policies are optimal, and address the issues of both wholesale and market pricing.

3 - Supply Chain Coordination under Random Selling Season: Quantity Buy-back and Price Protection
Mahdi Zanddizari, University of Maryland, 4803 Drexel Rd., College Park, MD, United States of America, mzd@umd.edu, Philip Evers

When time between and the demand during two successive product introductions are random, it is hard for the manufacturer to optimally produce and for the retailer to optimally order. To address this problem, this paper uses both incentives and return polices (quantity buy-back) to coordinate and Pareto improve the channel.

■ WA43

H-Room 400, Fourth Floor

Operational and Contractual Decisions in Inventory and Supply Chain Models

Cluster: Supply Chain Models
Invited Session

Chair: Arnab Bisi, Assistant Professor, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States of America, abisi@purdue.edu

1 - Effects of Upstream and Downstream Mergers on Supply Chain Performance
Jing Zhu, Desautels Faculty of Management, McGill University, Montreal, QC, Canada, jing.zhu2@mail.mcgill.ca, Saibal Ray, Tamer Boyaci

We study the effects of mergers in an oligopolistic market. In the benchmark case, we find that mergers always benefit the merging firms, while adversely affecting their dependent partners. We then analyze two extended models. If demand is random, most of the previous results hold true. If mergers induce operational synergy, then an upstream merger benefits not only the merging suppliers also the dependent retailers; a downstream merger benefits all the firms expect for the dependent suppliers.

2 - Designing Procurement Contracts When Buyers Compete

Jen-Yi Chen, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette, IN, 47906, United States of America, jaychen@purdue.edu, Maqbool Dada, Qiaohai Hu

When selling to two retailers who compete in input and consumer markets, a manufacturer can influence the nature of competition by carefully designing procurement contracts. In particular, we investigate the effects of the following elements on the profit of the supply network and its members: multi-ordering opportunities, leadership role, intra trading between retailers, and manufacturer's production flexibility. We find that a flexible manufacturer prefers non-intra-trading and non-leadership.

3 - The Censored Newsvendor Problem: Scalability, its Implications and Limitations

Arnab Bisi, Assistant Professor, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States of America, abisi@purdue.edu, Surya Tokdar, Maqbool Dada

We study the optimal policies in a dynamic newsvendor problem with censored demand. Both storable and perishable inventory models are analyzed over finite and infinite horizons. We show that the optimal policies are scalable if and only if the demand has a Weibull density. However, scalability property alone does not guarantee either exact or tractable optimal policies. We identify the cases that provide exact and easily computable optimal solutions.

4 - Capacity Sharing and Cost Allocation Among Independent Firms in the Presence of Congestion

Saif Benjaafar, Professor, University of Minnesota, Industrial and Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu, Yimin Yu, Yigal Gerchak

We analyze the benefit of production/service capacity sharing for a set of independent firms. Firms decide on capacity levels to minimize delay costs and capacity investment costs possibly subject to service level constraints. We formulate the problem as a cooperative game and identify a cost allocation that is in the core. In settings where unit delay costs are private information, we show how a cost allocation rule can be designed to induce all firms to report truthfully this information.

■ WA44

H-Room 402, Fourth Floor

Joint-Production Service Operations

Sponsor: Service Science
Sponsored Session

Chair: Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States of America, guillaume.roels@anderson.ucla.edu

1 - Contracting for Collaborative Services

Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States of America, guillaume.roels@anderson.ucla.edu

In this talk, we analyze the contracting issues that arise in collaborative services, such as consulting, financial planning, and IT outsourcing. We investigate how the choice of contract type, among fixed-fee, time-and-materials, and performance-based contracts, is driven by the service environment characteristics, such as output sensitivity, output complexity, and process improvement opportunities.

2 - Reverse-Engineering Business Software to Improve Service Redesign Time to Market

Philippe Dugerdil, Professor, Geneva School of Business Administration, 7 route de Drize, Geneva, 1227, Switzerland, philippe.dugerdil@hesge.ch

Today, business services are largely supported by software. When redesigning and improving services, the supporting information systems must be reengineered accordingly. However, this is by far the main hindrance to service redesign efficiency. Moreover, a fair part of the business service-related knowledge is actually embedded in software. Our project aims at recovering this knowledge in the software and identifying the relevant pieces of software to be adapted to the new service offering.

■ WA45

H-Room 410, Fouth Floor

New Product Development II

Contributed Session

Chair: Pascale Crama, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, Singapore, pcrama@smu.edu.sg

1 - Developing a Model for Product Modularity Using Multi-objective Optimization

Jebum Pyun, Korea University / Business School, Anam-dong, Seongbuk-gu, Seoul, 136-701, Korea, Republic of, chenille@korea.ac.kr, DaeSoo Kim, Myung-sub Park

The modularity has been known as a method to efficiently deal with diverse customers' needs along with postponement and mass customization. However, there are many conflicts arisen from it as well. Despite the importance in practice, there are only a few analytic studies. Thus, this research develops an analytic model for examining positive and negative effects of product modularity using multi-objective optimization.

2 - Time-to-market and Quality Trade-off

Ali Yassine, Professor, American University of Beirut, Beirutm Lebanon, Beirut, Lebanon, ay11@aub.edu.lb

A model is presented to study the tradeoff between time-to-market and product quality for different product development (PD) scenarios. These scenarios differ in four major factors: product complexity, task size, firm capability, and market nature. The objective of the proposed model is to maximize the profit with respect to a time limited window.

3 - A Design Partner Selection Model for Design Chain Collaboration

Jia-Ying Chen, PhD student, National Taiwan University, College of Management Floor 9, No.1,Sec., 4, Roosecelt Road, Taipei, Taiwan - ROC, d95741002@ntu.edu.tw, Ruey-Shan Guo, Ming Huang Chiang

Due to the increasing global competition and shorting product life for a new product, the brand owner increasingly collaborates with design chain partners to bring a new product to the market. As a result, this paper proposed a design partner selection model, which takes into account time-to-market, cost, and quality. An algorithm is also developed for this model to select the optimal partners through the design chain. Finally, a numerical example is presented.

4 - A Theory of Next Generation Products

Yi Zhu, University of Southern California, 3660 Trousdale Parkway, ACC 306E, Department of Marketing, USC, Los Angeles, CA, 90089, United States of America, zhuy@usc.edu, Lan Luo

Firms often launch next generation products to replace previous generation products. However, sometimes we also observe firms continue to produce and support the old generation products long after they launch the new generation products. We investigate how firms can exploit the interplay between the two generation products for profit maximization.

5 - Licensing Contracts: Options and Control Rights

Pascale Crama, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, Singapore, pcrama@smu.edu.sg

Research and Development cooperation is common in many development-intensive industries. We investigate how to structure the contract to offer the correct incentives to all involved parties when effort is hard to measure. In particular, we show that a contract specifying milestone payments or a royalty rate is unable to coordinate the R&D efforts. We investigate how options and the allocation of control rights can help to achieve higher value.

■ WA46

H-Room 411, Fourth Floor

Technology Licensing and Creativity

Sponsor: Technology Management
Sponsored Session

Chair: Lee Davis, Associate Professor, Copenhagen Business School, INO, Kilevej 14A, 3rd floor, Frederiksberg, DK-2000, Denmark, ld.ino@cbs.dk

1 - An Investigation of Stock Market Seasonality

Eric Bentzen, Associate Professor, Copenhagen Business School, Department of Operations Management, Frederiksberg, DK-2000, Denmark, eb.om@cbs.dk

In this paper we investigate the January effect on stocks traded at NYSE, AMEX, and NASDAQ. Unlike other empirical works we suggest expanding the model to cover several main effects. By doing so we find that the January effect is not the only effect, and it cannot be rejected that the effect from selected years are so powerful that it can affect the empirical findings.

2 - Realizing the Commercial Value of Employee Leisure Time Invention

Lee Davis, Associate Professor, Copenhagen Business School, INO, Kilevej 14A, 3rd floor, Frederiksberg, DK-2000, Denmark, ld.ino@cbs.dk

Managerial ability to combine different sources of employee knowledge can enhance innovation. There are many inventions where the flash of genius occurred while the inventor was away from work. But the resulting inventions are not necessarily valuable. This paper discusses four problems managers face in realizing this value: encouraging invention disclosure, facilitating knowledge transfer, minimizing leisure time shirking, and employee retention.

3 - Technology Licensing and Market Entry under Compatibility Investments

Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest St, Tomasso 123, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu, Sreekumar Bhaskaran

We examine a situation in which the supplier develops a new technology which enables him to offer a component of higher quality to a downstream OEM. The improved quality of the component would result in a better quality product if the OEM undertakes investments to enhance the compatibility of the component with the product. We analyze the issue of when and how a supplier would license his technology to another supplier with which he also competes for the demand of the OEM.

4 - Supply Network Configuration, Product Characteristics, and Ubiquitous Tracking Technology Adoption

Rahul Basole, Georgia Institute of Technology, Tennenbaum Institute, Atlanta, GA, 30332, United States of America, rahul.basole@ti.gatech.edu, Maciek Nowak

Research has found that matching supply networks and product characteristics leads to higher firm performance; recent studies have also examined the influence of tracking technologies on supply networks. We integrate these two research streams by developing a theoretical framework and a set of research propositions, and present results from an expert study conducted with supply chain executives to better understand strategic management of emerging information technologies in supply networks.

■ WA47

H-Room 412, Fourth Floor

Outsourcing

Contributed Session

Chair: Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

1 - System Dynamics Model of R&D Offshoring

R. Balachandra, Professor, Northeastern University, 360 Huntington Ave, 314 Hayden Hall, Boston, MA, 02115, United States of America, r.balachandra@neu.edu, Sagar Kamarthi

This paper presents a model that describes the behavior of an offshore/outsourcing activity using system dynamics approach. The model is built using the data related to firms engaged in offshoring technology development and R&D in India and China. The model helps managers identify and use the controls to affect the overall behavior of the offshoring activity.

2 - Diffusion of IT Outsourcing and Contagion Effects

Arti Mann, Arizona State University, P.O. Box 874606, Tempe, AZ 85287, United States of America, arti.mann@asu.edu, Kunsoo Han, Barrie Nault, Robert Kauffman

We explore the diffusion patterns of IT outsourcing. We estimate a lognormal diffusion curve to evaluate the presence of contagion effects; study the influence of mega-deals; use multiple stratifiers to test for hierarchical contagion effects; and evaluate the role of communication channels. We find that the diffusion patterns are not lognormal, and that during contagion periods the large and visible firms may act as exemplars for smaller firms, reducing their inhibitions to adopt IT outsourcing.

3 - The Impact of Trade in IT Goods and Outsourcing on IT Industry Performance

YenChun Chou, PhD Student, Arizona State University, W. P. Carey School of Business, Tempe, United States of America, yen-chun.chou@asu.edu, Benjamin Shao, Robert Kauffman

The information technology (IT) industry plays a critical role in a country's overall economic growth by enhancing utilization of capital and labor, and creating productivity and efficiency gains. Using panel data on the IT industry for a set of OECD countries from 2000-2006, we perform stochastic production frontier estimation. We explore the impacts of IT outsourcing, trade in IT goods, and foreign direct investments on the productivity and efficiency of the IT industry. We also evaluate alternative explanatory models to handle cross-country heterogeneity.

4 - An Investigation of HR Outsourcing in Singaporean Companies

Thompson Teo, NUS, Department of Decision Sciences, NUS, Singapore, Singapore, bizteosh@nus.edu.sg, Xiuxi Zhao

HR outsourcing is the hiring of an outside party to perform the HR activities that used to be performed in house.Based on interviews of HR practitioners in five companies in Singapore, we categorize HR outsourcing into three types that represent different levels of boundary changes. By telephone interviewing 187 of 560 listed companies in Singapore, we found that the higher level boundary change, the less likely that the HR functions are outsourced.

5 - To Outsource, or Not? If so, Where? Mexico, China, or U.S.

Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

Outsourcing of manufacturing to Mexico and China includes costs that are not always considered and benefits that are not always correctly quantified. An analytical model for determining outsourcing costs was developed and results from that model are presented. Using that model, the sensitivity of outsourcing costs to several variables was modeled and analyzed.

■ WA48

H-Sapphire Green Room, Fourth

Panel Discussion: Future OM Research Possibilities Within Health Care

Cluster: Service Operations Management
Invited Session

Chair: Berit Irene Helgheim, Associate Professor, Molde University College, P.O. Box 2110, Molde, Norway, berit.i.helgheim@himolde.no

1 - Future OM Research Possibilities Within Health Care

Moderator: Berit Irene Helgheim, Associate Professor, Molde University College, P.O. Box 2110, Molde, Norway, berit.i.helgheim@himolde.no

Health Care is a large industry. Rising costs, inefficiency and poor quality performance has made health care an emerging OM research field. Health Care OM, Patient Flow and Hospital OM are important for health care efficiency. Collaboration between practitioners and researchers may give more insight into the complexity of this field. In this session, practitioners from the hospital industry will present their production models/philosophies and reflect upon future research needs within OM.

■ WA49

H-Room 300, Third Floor

Strategic Models for Mitigating Supply Chain Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Larry Snyder, Assistant Professor, Lehigh University, Department of Industrial & Systems Eng, 200 West Packer Ave., Mohler Lab, Bethlehem, PA, 18015, United States of America, larry.snyder@Lehigh.EDU

1 - Bullwhip and Reverse Bullwhip Effects under the Rationing Game

Ying Rong, University of California-Berkeley, Dept of IEOR, Berkeley, CA, United States of America, yir204@lehigh.edu, Larry Snyder, 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 examine this issue by focusing on the relationships among the variances of the supplier's capacity, the retailers' orders, and the customers' demand. We prove that the reverse bullwhip effect, in which the retailers' order variance is higher than the capacity variance, occurs between the supplier and the retailers.

2 - A Comparative Study of Optimizing Protection Strategies Using Various Measures of Uncertainty

Paola Scaparra, Lecturer, Kent Business School, University of Kent, Canterbury, CT2 7PE, United Kingdom, M.P.Scaparra@kent.ac.uk, Federico Liberatore

We present expected cost and regret models to optimize the allocation of protective resources in supply chains which are vulnerable to disruptions of uncertain size. We compare the protection strategies generated by using different objectives and analyse the robustness of the solutions produced by the proposed models.

3 - A Discrete Location Problem with Premeditated Facility Disruptions

Michael Lim, University of Illinois Urbana-Champaign, Urbana-Champaign, IL, United States of America, m-lim2@northwestern.edu, Sunil Chopra, Mark Daskin, Achal Bassamboo

We consider premeditated attacks on supply chain networks. We propose a two population genetic algorithm to solve a defender-interdictor location problem (Scaparra and Church, 2008). Our algorithm can be extended to a wide range of applications. Using a case example, we show that the algorithm is promising for large-scale problems.

■ WA50

H-Room 302, Third Floor

Service Quality and Congestion

Sponsor: MSOM/ Service Management
Sponsored Session

Chair: Peng Sun, Duke University, One Towerview Rd, Durham, United States of America, peng.sun@duke.edu

1 - Teaching Your Customers to Play Nash

Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Achal Bassamboo

Delay announcements informing customers about anticipated delays are prevalent in service-oriented systems. We study a myopic learning scheme that allows the firms and the customers to update their beliefs about the "meaning" of the messages, based on their delay experience. We show how the true meaning of message emerges when there is an equilibrium.

2 - Decision Accuracy under Congestion in Service Systems

Peng Sun, Associate Professor, Duke University, One Towerview Rd, Durham, NC, 27708, United States of America, psun@duke.edu, Francis de Vericourt

We present the dynamic control of a service system in which the provider needs to trade off the value of taking time to make an accurate judgment against the cost of delaying the provision of service to others in the system. The agent's decision process is modeled as an elicitation sequence of probabilistic cues. We characterize the structure of the optimal decision, investigate impact of congestion to decision accuracy, and study cognitively simple control policies that perform well.

3 - Optimal Staffing with Endogenous Goals

Buket Avci, PhD Student, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Buket.AVCI@insead.edu, Francis de Vericourt, Ioana Popescu

We investigate the optimal staffing level decision of a firm, when employee performance is indirectly affected by staffing levels through workload. In the spirit of Prospect Theory, we posit that goals act as reference points, and there is an asymmetry between under and over-performance relative to a goal. We solve the corresponding principal-agent model in a queueing context and characterize conditions when endogenous goals are relevant for staffing decisions.

■ WA51

H-Room 303, Third Floor

Computational Stochastic Mixed-Integer Programming

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu

1 - L-Shaped BONUS Algorithm for Large Scale Stochastic Mixed Integer Nonlinear Programming Problem Solutions

Urmila Diwekar, President, Vishwamitra Research Institute, 368 56-th Street, Clarendon Hills, IL, 60514, United States of America, urmila@vri-custom.org, Yogendra Shastri

This work proposes a new algorithm called L-shaped BONUS to overcome computational issues of stochastic mixed integer nonlinear programming problems. The algorithm has been applied to solve various problems to illustrate the computational advantages. The results show that the computational time increases exponentially for the sampling based L-shaped method with increasing sample size while it increases linearly for the proposed L-shaped BONUS algorithm.

2 - Mixed-Integer Stochastic Decomposition for Two-Stage Stochastic Integer Programming

Yang Yuan, PhD Candidate, The Ohio State University, 1971 Neil Ave, Columbus, OH, 43210, United States of America, yuan.65@osu.edu, Suvrajeet Sen

Most studies in stochastic integer programming represent uncertainty by a finite number of scenarios. In this talk, we propose a statistical algorithm for two-stage stochastic integer programming problems with infinitely many scenarios by extracting information from the empirical scenario pool through sequential sampling. This algorithm can be referred to as mixed-integer stochastic decomposition.

3 - Disjunctive Decomposition for Two-Stage Stochastic Mixed-Binary Programs with GUB Constraints

Brian Keller, University of Arizona, Systems and Industrial Engineering, Tucson, AZ, United States of America, kellerbd@email.arizona.edu, Guzin Bayraksan

We present computational enhancements to the disjunctive decomposition algorithm for mixed 0-1 stochastic programs. We explore the use of a restricted cut generation problem and examine problems with generalized upper bound constraints in the second-stage. We exploit this structure to generate cuts based on alternative disjunctions. We establish convergence and present computational results on a new stochastic scheduling problem. The enhancements reduced computation time on average by 45%.

■ WA52

H-Room 304, Third Floor

Competition and Innovation in Supply Chains

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Yi Xu, Assistant Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, yxu@rhsmith.umd.edu

1 - Buyer Incentives for Supplier Investments in Process and Product Innovations

Gal Raz, University of Virginia, Charlottesville, VA, 22903, razg@darden.virginia.edu, Cheryl Druehl

We study a supply chain that sells a product to end consumers in a newsvendor setting. The supply chain consists of a buyer and a supplier, where the supplier must determine the investment in process (cost reduction) and product (value addition) improvements. We consider the centralized case as a benchmark and then analyze the decentralized supply chain. We examine how much a firm loses by outsourcing innovation as well as how the process and product innovation affects the supply chain outcomes.

2 - Contracting Product Quality in Multiple-Level Supply Chains

Yan Dong, Assistant Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, yandong@rhsmith.umd.edu, Kefeng Xu, Annabelle Feng, Xiang Wan

We propose a supply chain framework of a sequential quality management process where the finished product quality depends on the manufacturer quality, which is affected by component quality. We establish and examine various types of quality incentive mechanisms with implications on efficiency and effectiveness of supply chain quality management. We examine the impact of supply chain structures on supply chain performances in product quality and profitability.

3 - Supply Chain Relationships: The Role of Mediation

Karan Girotra, Assistant Professor, INSEAD, Boulevard De Constance, Fontainebleau, France, karan.girotra@insead.edu, Elena Belavina

Firms are often advised to either, enter into a long-run relationship with their supply chain partners, and enjoy the benefits of improved incentive alignment (such as high quality, substantial capacity, etc.); alternately, firms can frequently change partners, and reap the benefits afforded by this flexibility in a changing environment. We propose an alternate structure of sourcing, mediated sourcing, which can outperform either of the two traditional strategies.

■ WA53

H-Room 305, Third Floor

Topics in Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Matthias Koeppe, Asst. Professor, University of California, Davis, Department of Mathematics, One Shields Avenue, Davis, CA, 95616, United States of America, mkoeppe@math.ucdavis.edu

1 - A Parametric Integer Programming Algorithm for Bilevel Mixed Integer Programs

Christopher T. Ryan, Sauder School of Business, University of British Columbia, Vancouver, Canada, chrisryan1789@gmail.com, Maurice Queyranne, Matthias Koeppe

We consider discrete bilevel programs where the follower solves an integer program with a fixed number of variables. Using results in parametric integer programming, we present a polynomial time algorithms for mixed integer bilevel programs. Our algorithm also detects whether the infimum cost is attained, a difficulty that has been identified but not directly addressed in the literature. It yields an approximation scheme with running time polynomial in the logarithm of the relative precision.

2 - The Summation Method for Integer and Continuous Optimization

Matthias Koeppe, Asst. Professor, University of California, Davis, Department of Mathematics, One Shields Avenue, Davis, CA, 95616, United States of America, mkoeppe@math.ucdavis.edu, Jesus De Loera, Velleda Baldoni, Nicole Berline, Michèle Vergne

By viewing the maximum of a function as the limit of certain sums or integrals, efficient summation / integration procedures yield approximation algorithms for optimization problems. We study exact integration procedures for polynomial functions. Via Euler-Maclaurin formulas, these are useful also in the integer setting. The methods are related to Brion's formulas, Barvinok's exponential sums, and to the polynomial Waring problem (polynomials as sums of few linear forms).

3 - Linear Programming Methods for Phylogeny Construction

Fumei Lam, U.C. Davis, Department of Computer Science, 1 Shields Ave, Davis, CA, 95616, United States of America, flam@cs.ucdavis.edu

We apply linear programming methods to the problem of triangulating colored graphs, a problem motivated by the construction of phylogenetic trees (or evolutionary histories) in computational biology. We describe several approaches which exploit the general theoretical framework and combinatorial structure of the phylogeny problem for multiple state characters and explore the empirical behavior of the linear programming methods in practice.

■ WA54

H-Room 306A, Third Floor

Sublinear Time Algorithms

Sponsor: Optimization/Networks
Sponsored Session

Chair: Asaf Shapira, Georgia Institute of Technology, School of Mathematics, 686 Cherry Street, Atlanta, GA, 30332-0160, United States of America, asafico@math.gatech.edu

1 - Transitive-closure Spanners

Elena Grigorescu, MIT, 28 Inman St., Apt 3, Cambridge, MA, 02139, United States of America, elena_g@mit.edu, Arnab Bhattacharyya, David Woodruff, Kyomin Jung, Sofya Raskhodnikova

We define the notion of a transitive-closure spanner of a directed graph: a small diameter graph that preserves the connectivity of the original graph. These spanners were studied implicitly in sublinear algorithms, access control, and data structures. We abstract the common task tackled in these applications as the problem of constructing sparse TC-spanners, which we study on specific graph families. We will explain some ramifications of these results for testing monotonicity of functions.

2 - Testing Halfspaces

Kevin Matulef, MIT, 3 Ames St, Box C, Cambridge, MA, 02142, United States of America, matulef@csail.mit.edu, Ronitt Rubinfeld, Ryan O'Donnell, Rocco Servedio

We address the problem of testing whether a Boolean-valued function f is a halfspace, i.e. a function of the form f(x) = sgn(w * x - t). We consider halfspaces over the continuous domain R^n as well as halfspaces over the Boolean cube {‚à'1,1}^n. In both cases we give an algorithm that distinguishes halfspaces from functions that are epsilon-far from any halfspace using only poly(1/epsilon) queries, independent of the dimension n.

3 - Sublinear Graph Approximation Algorithms

Krzysztof Onak, Massachusetts Institute of Technology, 32 Vassar St., Rm 32-G696, Cambridge, MA, 02139, United States of America, konak@MIT.EDU, Huy Nguyen

Solving a graph optimization problem usually requires processing the entire input. I will show that an approximate size of the optimal solution can often be computed in time that is independent of the number of nodes in the graph. In particular, I will present the first algorithm that additively approximates the fraction of nodes matched in the maximum matching in time that is a function of only the average node degree and a bound on the additive error.

4 - Lower Bounds for Testing Triangle Freeness in Boolean Functions

Arnab Bhattacharyya, MIT, 32 Vassar St., Room G696, Cambridge, MA, United States of America, abhatt@mit.edu, Ning XIE

Let f, g, h : {0,1}^n -> {0,1} be three Boolean functions. (f, g, h) is said to be triangle-free if there are no x and y such that f(x) = g(y) = h(x+y) = 1. The canonical tester for triangle-freeness repeatedly picks x and y uniformly at random and checks if f(x) = g(y) = h(x+y) = 1. The tester needs to pick enough queries to distinguish triangle-free functions from those far from triangle-free. Our main result is a non-trivial lower bound for the query complexity of the canonical tester.

■ WA55

H-Room 306B, Third Floor

Inventory Routing Problems

Contributed Session

Chair: Peter Hulshof, PhD Candidate, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, p.j.h.hulshof@utwente.nl

1 - Inventory Routing Optimization for Bulk Gas Transportation

Thierry Benoist, Bouygues e-lab, 40 rue de Washington, Paris, 75008, France, tbenoist@bouygues.com, Bertrand Estellon, Frédéric Gardi, Antoine Jeanjean, Sachin Jain, Emmanuelle Patay

Inventory Routing is a generalization of Vehicle Routing with vendor managed inventory replenishment. We describe a local search algorithm designed for a real life model of this problem. Based on small neighborhoods with highly optimized underlying routines, this software is operational in North America and makes it possible to envision an important reduction of Air Liquide delivery costs and carbon footprint.

2 - Vehicle Routing with Alternative Access Airport Selection for Air Cargo

Farshid Azadian, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States of America, f_azadian@wayne.edu, Alper Murat, Ratna Babu Chinnam

The utilization of previously contracted air cargo capacity and provision of higher service level are two most common problems faced by many regional and national freight forwarders. This paper considers capacitated vehicle routing problem with time-windows where vehicles' final delivery location needs to be decided in addition to routing decisions. The final delivery location is one of the regional airports where there are multiple flights available for freight forwarder.

3 - Real-time Distribution of Perishable Goods Using Past Request Information to Forecast Future Demand

Francesco Ferrucci, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42097, Germany, fferrucci@winfor.de, Michel Gendreau, Stefan Bock

This talk introduces a real-world variant of the well-known Dynamic Vehicle Routing Problem (DVRP). In this DVRP, goods have to be delivered under extreme time pressure because of their high perishability. In order to increase quality of service, future demands are anticipated by applying sophisticated methods for analyzing historical data and request forecasting. The efficiency of the applied instruments is analyzed using computational experiments.

4 - Heuristic Approach for the Inventory Routing Problem with Workload Balancing

Peter Hulshof, PhD Candidate, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, p.j.h.hulshof@utwente.nl, Goos Kant, Arjan Hoendervoogt

We consider the deterministic Inventory Routing Problem (IRP): minimize transportation costs for a longer period, subject to constraints. By formulating it as a Periodic Vehicle Routing Problem, we are able to solve large IRPs and to balance weekly and seasonal periods. For several cases, we show more than 20% increase of volume per kilometer and a decrease of 7% in customer visits compared to the current situation. The formulation is new and implemented in software with positive feedback.

■ WA56

H-Room 307, Third Floor

Dynamic Pricing in Revenue Management

Contributed Session

Chair: Mike von Massow, McMaster University, RR# 2, 76 Gilkison St, Elora, ON, N0B 1S0, Canada, vonmasm@mcmaster.ca

1 - Dynamic Pricing of Multiple Products and Customer Negotiation
Kwei-Long Huang, Assistant Professor, National Taiwan University, 85 Sec 4, Roosevelt RD., Taipei, 106, Taiwan - ROC, kl.huang@im.ntu.edu.tw, Chia-Wei Kuo

We consider a retailer selling two substitutable products with limited inventory over a predetermined selling horizon. Initially, the retailer offers the first product to an arriving customer. If the transaction fails, the second product is provided. The retailer decides for which product she allows the customer to bargain, but not both. We characterize the optimal posted prices and compare the expected revenue of the retailer for both settings.

2 - Dynamic Pricing under Competition with Coupling Constraints
Ruxian Wang, PhD Student, IEOR Department, Columbia University, 313, 500W, 120 St, New York, NY, 10027, United States of America, rw2267@columbia.edu, Guillermo Gallego

In this paper, we consider oligopoly pricing problems where player can sell their own capacity as capacity belonging to competitors. The players compete for customers and capacities by dynamically changing prices. We formulate this problem into a finite horizon differential game with coupling constraints and characterize the equilibrium.

3 - Dynamic Cross-selling in E-commerce Using 'Hub-authority' Ranking Framework
Arun Timalsina, Wayne State University, 4815 Fourth St #1073, Detroit, MI, 48201, United States of America, t.arun@wayne.edu, Ratna Babu Chinnam, Alper Murat

Selection of packaging complements and dynamic pricing are the primary problems in dynamic cross-selling set-up. Problem complexity grows rapidly for traditional optimization methods with SKUs. For e-tailers handling 100s to 1000s of SKUs, like Amazon.com, the scaling issue dominates DP type approaches. We propose a Hub-Authority ranking based framework for dynamic cross-selling.

4 - Optimal Dynamic Pricing and Inventory Policies for Fashion Retailers
Samuel Huang, University of Texas at Austin, IROM, 1 University Station B6500, Austin, TX, 78712, United States of America, SamuelHuang@mail.utexas.edu, Edward Anderson, Genaro Gutierrez

We study the problem of dynamic pricing and inventory policies of a fashion retailer who faces the challenge of having short product life cycle but long production lead time. We show how the retailer can make coordinated pricing and inventory decisions when facing uncertain demand. Closed-form solutions are found for special demand distributions and an approximation is provided for the general demand distribution.

5 - Pricing Strategy in the Presence of Reference Prices with Thresholds
Mike von Massow, McMaster University, RR# 2, 76 Gilkison St, Elora, ON, N0B 1S0, Canada, vonmasm@mcmaster.ca, Hassini Elkafi

We propose a reference price model with thresholds within which there are no reference effects. Previous reference models have been limited to either single price or cyclical price strategies when addressing inter-temporal effects. The incorporation of thresholds allows for both pricing strategies depending on the parameters of the model. We implement a dynamic programming model to investigate the conditions under which price cycles and those under which a constant price is optimal.

■ WA57

H-Room 308, Third Floor

Informing Health Policy through Operations Research

Sponsor: Health Applications
Sponsored Session

Chair: Jonathan Turner, PhD Student, Northewestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, JonathanTurner@u.northwestern.edu

1 - Determining the Waiting Lists an End-stage Liver Disease Patient Should Join
Gorkem Saka, Health Economist, Merck Research Labs, Merck & Co., Inc., Upper Gwynedd, PA, United States of America, gorkem_saka@merck.com, Lisa Maillart, Andrew Schaefer, Oguzhan Alagoz, Mark S. Roberts

ESLD patients are allowed to join multiple waiting lists in order to be eligible for cadaveric organs. We analyze the question of which waiting lists a patient should join to maximize expected life years subject to either a cardinality or a budget constraint. We model the problem in three stages: selecting an original waiting list, joining additional lists, and accepting/declining livers. We show that the multiple listing problem is NP-hard and present numerical results based on clinical data.

2 - Evaluating the Impact of Aging at Home Strategies
Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca, Ali Vahit Esensoy

As people age, they generally prefer to stay in their own home. Unfortunately, it is often necessary to move to long term care for simple reasons such as meal preparation and daily help. By providing more home services, we may be able to reduce demand for long term care beds and alleviate bottlenecks in the system in addition to providing better and less expensive care. We will discuss some of our work on modelling Aging At Home in Ontario.

3 - Policy Analysis of Concurrency Reduction Strategies for HIV Prevention
Eva Enns, PhD Student, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu, Margaret Brandeau, Thomas Igeme, Eran Bendavid

Concurrent sexual partnerships allow for efficient HIV transmission through an interconnected network of individuals. We use a network model to compare the effects of concurrency reduction campaigns on the course of the HIV epidemic in a population of sexually active adults. We compare the outcomes of campaigns that are 10% effective at: (1) increasing the number of monogamous individuals; (2) reducing individuals' average number of partners; and (3) reducing rates of sexual partner change.

4 - Continuity of Care as a Function of Surgical Residents' Rotation Durations
Jonathan Turner, PhD Student, Northewestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, JonathanTurner@u.northwestern.edu

Surgical residents typically spend one to two months in their rotations. This policy has not been evaluated in operations research literature or medical literature. We show how the continuity of care residents' patients experience is a function of rotation durations and propose several easy to implement policies that can improve continuity of care.

■ WA58

H-Room 309, Third Floor

Crew Scheduling

Contributed Session

Chair: Wenxin Qiao, University of Maryland-College Park, 1179 Glenn L. Martin Hall, University of Maryland, College Park, MD, 20742, United States of America, wxqiao@umd.edu

1 - Large Scale Crew Rostering - A Combined Local Search and Column Generation Approach
Hamid Kharraziha, Optimization Expert, Jeppesen Systems, P.O Box 192, Gothenburg, SE-401 23, Sweden, hamid.kharraziha@jeppesen.com, Tomas Gustafsson

Large scale weighted fair share crew rostering problems are in themselves very challenging to solve. If you add the requirement that the approach should work for more or less any airline without significant changes, the challenge increase dramatically. We will describe the current Jeppesen approach in production with many major airlines and discuss further ideas to increase performance.

2 - Iterative Algorithms for the Curfew Planning Problem
Suat Bog, University of Florida, Department of Industrial and Systems, Engineering, Gainesville, FL, 32611, United States of America, sbog@ufl.edu, Ashish Nemani, Ravindra Ahuja

The curfew planning problem (CPP) is to design an annual timetable for railway track maintenance teams. Each team is capable of handling different types of projects. The timetable gives project-team assignments on a weekly basis for the whole year. The objective is to design a schedule minimizing network disruptions caused by ongoing curfew requiring projects. We develop four optimization-based iterative algorithms to tackle with this problem and we present very promising computational results.

3 - MCMP Model for Flexible Hotel Cleaning Scheduling
Liying Cui, PhD Candidate, Penn State University, 121 EE East, University Park, PA, 16802, United States of America, luc5@psu.edu, Soundar Kumara

Multi-criteria mathematical programming (MCMP) model with time windowing technique is recommended for hotel scheduling problem with flexible number of cleaning personal. MCMP is used to make the cleaning schedule for the next operation day at the end of the current day. MCMP model is able to find the optimal solution, and schedule flexibly in terms of the number of cleaning staff working during the next operational day. In addition, time windowing technique simplifies the scheduling problem.

4 - Airport Staff Scheduling with Non-homogeneous Skills
Yong Hong Kuo, Chinese University of Hong Kong, SEEM Dept, CUHK, Shatin, Hong Kong, Hong Kong - PRC, yhkuo@se.cuhk.edu.hk, Yizhong Lin

A staff scheduling problem for airline airport operations is discussed in this talk. The objective is to minimize the manpower at each gate subject to the demand being satisfied. The skills requirement of staff is taken into consideration. Two models of mixed integer formulation are presented and compared.

5 - A Bin Packing Approach to the Crew Scheduling Problem
Wenxin Qiao, University of Maryland-College Park, 1179 Glenn L. Martin Hall, University of Maryland, College Park, MD, 20742, United States of America, wxqiao@umd.edu, Masoud Hamedi, Ali Haghani

This paper proposed a new approach for solving traditional crew scheduling problem. The problem is solved with a bin packing approach in polynomial time. Based on literature research, an algorithm that is proved to be the most efficient for solving most bin packing problems is selected and modified for application in crew scheduling problem. A Modified Best-Fit-Decreasing Algorithm is proposed and discussed. A case study is conducted using the proposed algorithm and results are discussed.

■ WA59

H-Room 310, Third Floor

Tutorial: Lean Six Sigma in Services

Cluster: Tutorials
Invited Session

Chair: Uday Apte, Professor, Naval Postgraduate School, Graduate School of Business and Public P, 555 Dyer Road, Monterey, CA, 93943, United States of America, umapte@nps.edu

1 - Lean Six Sigma in Services
Uday Apte, Professor, Naval Postgraduate School, Graduate School of Business and Public P, 555 Dyer Road, Monterey, CA, 93943, United States of America, umapte@nps.edu

Two major process improvement methodologies, "Lean" and "Six Sigma", emerged separately in the 20th century. Presently, we are witnessing the merger of these two and the emergence of "Lean Six Sigma" In this tutorial, we will provide an introduction and an overview of Lean Six Sigma with a specific emphasis on its application to service industries. The tutorial should help researchers and practitioners alike in teaching, consulting and the practice of OM.

■ WA60

H-Room 311, Third Floor

Convex Optimization

Contributed Session

Chair: Yahya Fathi, Professor of Industrial and Systems Engineering, North Carolina State University, Campus Box 7913, North Carolina State University, Raleigh, NC, 27695, United States of America, fathi@eos.ncsu.edu

1 - Improved Algorithm For Computing the Frame of a Finitely-Generated Bounded Polyhedron
Xinyu Wang, PhD Student, SMU, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, xwang@smu.edu

We explore several enhancements for improved efficiency in computing the minimal generators of the convex hull polyhedron. We address preprocessing in two-dimensional slices and enhancements to projections on a partial convex hull including temporarily fixing the hull size for several iterations and splitting the hyperplane used to obtain extreme points. We present experimental results using combinations of these tools in several data set scenarios.

2 - Polynomial Approximation on Logconcave Chance Constraints
Dongxue Ma, Graduate Assistant, University of Louisville, 2301 3rd Street, Louisville, KY, 40292, United States of America, d0ma0001@louisville.edu

We propose a Weierstrass-like polynomial approximate approach to solve stochastic log-concave chance constraint problems. We simulate the constraints by Monte-Carlo and build an arbitrary polynomial approximate thereafter without costing convexity. Comparing with well established scenario approximation, sample average approximation methods, the polynomial approximation reveals arbitrary first order gradient approximate as well and reduction in computational overhead.

3 - The Minimum-volume Ellipsoid Estimator: Fast Exact and Inexact Solutions
S. Damla Ahipasaoglu, Cornell University, 222 University Ave. Apt:5, Ithaca, NY, 1850, United States of America, dse8@cornell.edu, Michael J. Todd

Given an arbitrary data set, which has m distinct points, the Minimum-Volume Ellipsoid (MVE) estimator is defined to be the ellipsoid of minimum volume containing at least h points. The MVE estimator is an important tool in robust regression and outlier detection in statistics. The problem of finding the MVE estimator is a hard combinatorial problem. We will develop a 2-exchange heuristic and a Branch-and-Bound algorithm, and present computational results.

4 - Variational Sets of Multivalued Mappings: Calculus and Optimality Conditions for Vector Optimization
Quoc Khanh Phan, Professor, DSc, PhD, International University of Hochiminh City, Vietnam, Khu pho 6, Linh Trung, Thu Duc, Hochiminh City, Vietnam, pqkhanh@hcmiu.edu.vn

We propose two kinds of higher-order variational sets for multivalued mappings to play the role of generalized derivatives in nonsmooth optimization. Elements of calculus for these sets are developed. Both necessary and sufficient optimality conditions of higher orders are established for various types of solutions to vector optimization problems. These conditions improve or include as special cases many recent results in the literature.

5 - The Nearest Point Problem in a Polyhedral Set and its Extensions
Zhe Liu, Research Assistant, North Carolina State University, 2500 Stinson Drive, Raleigh, NC, 27606, United States of America, zliu@ncsu.edu, Yahya Fathi

We investigate the relationship between the nearest point problem in a polyhedral cone (NPPC) and the nearest point problem in a polyhedral set and its extension to the strictly convex quadratic programming problem with linear constraints. We then employ the active index algorithm for NPPC to solve the latter two problems. Our preliminary computational results show that for a relatively large collection of instances with dense matrices this approach is more efficient than CPLEX11.

■ WA61

H-Room 312, Third Floor

Heuristic Programming

Contributed Session

Chair: Clara Novoa, Assistant Professor, Texas State University, 120 Azolar Dr, San Marcos, TX, 78666, United States of America, cn17@txstate.edu

1 - Parallel Algorithms and Restart Strategies
Oleg Shylo, University of Florida, Weil Hall 301, Gainesville, FL, 3208, United States of America, shylo@ufl.edu

We investigate the relationship between the restart properties of the algorithms and their parallel performance. The algorithm portfolio is considered and the limitations of the best portfolio performance are discussed.

2 - Flexible Size Cutting Stock Optimization for Steel Mother Plate Design
Juyoung Wy, Industrial & Management Engineering, POSTECH (Pohang University of Science & Technology), San 31, Hyoja-Dong, Pohang, Kyungbuk, Korea, Republic of, hwiriric@postech.ac.kr, Sojung Son, Byung-In Kim

This talk introduces the steel mother plate design problem, which may be considered as a two-staged guillotine cut, two-dimensional cutting stock problem with flexible cutting stock size. We will present several mathematical models, and propose an iterative two-phase heuristic method consisting of several algorithms for the problem. The effectiveness of the proposed method will be demonstrated by some computational results.

3 - A Comparative Study of the Inexact Methods for Solving the View and Index Selection Problem
Zohreh Asgharzadeh Talebi, Research Assistant, North Carolina State University, Campus Box 7913, Raleigh, NC, 27695, United States of America, zasghar@ncsu.edu, Rada Chirkova, Yahya Fathi

We introduce several IP based heuristic algorithms for solving the view and index selection problem in the context of online analytical processing. Our approaches take advantage of the special structure of the problem to reduce the search space

of potentially beneficial views and indexes. We then apply the IP model that we introduced for this problem on the reduced search space. We compare our approaches with two well-known greedy based approaches in the literature and report our findings.

4 - A Genetic Algorithm for Feature Selection with Caching Implementation and a Hybrid Parallel Approach

Clara Novoa, Assistant Professor, Texas State University, 120 Azolar Dr, San Marcos, TX, 78666, United States of America, cn17@txstate.edu

This work presents a Genetic Algorithm for selecting an optimal subset of features for studying processor workload characterization, especially power performance, a design issue for semiconductor companies. By implementing software caching, locality of reference in the search is explored resulting in reuse of data from previous iterations. Additional computational advantages are studied from a hybrid implementation of the algorithm that uses MPI and shared-memory OpenMP parallelization protocols

■ WA62

H-Room 313, Third Floor

Behavioral Operations

Contributed Session

Chair: Anand Nair, Moore School of Business, University of South Carolina, 1705 College St., Columbia, SC, 29208, United States of America, nair@moore.sc.edu

1 - Setting Customer Expectation and Capacity Planning in Service Systems

Liu Yang, Duke University, 4225 larchmont rd, apt 936, Durham, 27707, United States of America, ly11@duke.edu, Francis de Vericourt, Peng Sun

We study a service firm which chooses to announce a delivery time to set customer expectation. A customer's joining decision depends on the announced delivery time and also on WOM which is affected by average customer satisfaction level. We examine the firm's optimal strategies in announced delivery time and capacity planning.

2 - Out of Sight, Out of Mind: Asymmetric Learning When Demand is Censored by Inventory

Jordan Tong, Duke University: The Fuqua School of Business, 1 Towerview Dr., Durham, NC, 27708, United States of America, jordan.tong@duke.edu, Daniel Feiler, Rick Larrick

Firms often face an unknown demand distribution and must estimate demand using historical data. In most retail settings, only sales data rather than actual demand data are accessible. This paper examines how individuals learn with censored feedback. We show decision makers demonstrate asymmetric learning such that beliefs are biased toward the direction of clear feedback. Thus, they systematically underestimate demand and orders are biased low. We also present a simple debiasing technique.

3 - A Periodical Review Inventory System with S-shaped Utility Function

Xiaobo Zhao, Professor, Tsinghua University, Department of IE, Beijing, China, xbzhao@tsinghua.edu.cn, Wei Geng, Deng Gao

The prospect theory shows that some human behaviors can be characterized by an S-shaped utility function. We discuss a periodical review inventory system with an S-shaped utility function. For a single period system, it is shown that there exists a state-dependent order-up-to policy to be optimal, which can be obtained by a simple search method. For a multi-period system, bounds of optimal order-up-to levels are given, based on which an optimal policy can be obtained by an iterative algorithm.

4 - Examining Power Dynamics in Buyer-Supplier Relationships - Theoretical & Experimental Investigation

Anand Nair, Moore School of Business, University of South Carolina, 1705 College St., Columbia, SC, 29208, United States of America, nair@moore.sc.edu, Elliot Bendoly, Ram Narasimhan

This study investigates how dynamic investments in strategic assets are influenced by the locus of bargaining power and by the underlying context (synergistic vs. adversarial) of the interfirm relationship. The dynamic evolution of bargaining power is also examined. An analytical approach combined with a behavioral experiment is used to investigate the research issues.

■ WA63

H-Room 314, Third Floor

Process Analysis in Health Care II

Contributed Session

Chair: Samuel Hohmann, University HealthSystem Consortium, 2001 Spring Road, Suite 700, Oak Brook, IL, United States of America, hohmann@uhc.edu

1 - ProFound: A Modular Framework for the Simulation and Evaluation of Complex Workflows

Andrey Torzhkov, Siemens Corporate Research, Princeton, NJ, andrey.torzhkov@siemens.com, Karin Noy, Gayle Wittenberg, Mathaeus Dejori

Current state-of-the-art software for workflow construction, simulation, and evaluation is cumbersome for complex projects. Workflows consist of many redundant structures, making it difficult to edit and debug the constructed workflows. We present ProFound, a software framework for the rapid design, evaluation and optimization of workflows in the healthcare, industrial and energy domains. Following a modular design principle, new workflows can be constructed by simply connecting modules.

2 - Improving Fire Rescue in Hospital by Using RFID, GIS, and PDA Integration

Ieelong Chen, PhD Student, North Dakota State University, 1301 12th Avenue North, Fargo, ND, 58102, United States of America, ieelong.chen@ndsu.edu

When calamity happens, how to effectively deal with the emergency is a significant task for emergency rescue units. We simply created the standard rescue procedures and focused on (a) receiving the tragedy reports, (b) inquiring the available hospital buildings' drawings, and (c) working as a team member in a rescue operation with other emergency responders on scene.
Proper protocols and using technologies could improve overall health care facilities' safety and operational efficiency.

3 - How to Use Healthcare Operational Data for Benchmarking and Improving Supply Chain Management

Samuel Hohmann, University HealthSystem Consortium, 2001 Spring Road, Suite 700, Oak Brook, IL, United States of America, hohmann@uhc.edu, Shital Shah

UHC is a cooperative of academic medical centers (AMCs) whose collaborative activities include contributing operational data to a pooled database to conduct benchmarking and performance improvement activites. Improving supply chain management will be described better performers idenntified. Results of DEA will be compared to traditional analysis.

■ WA64

H-Room 202A, Second Floor

Education III

Contributed Session

Chair: Jay Parsons, Colorado State University, 3226 Ledgestone Court, Fort Collins, CO, 80528, United States of America, jay.parsons@OptimalAg.com

1 - Effects of Ubiquitous Technology Characteristics on Interaction and Satisfaction on the m-Learning Systems

Sanghee Lee, PhD Candidate, Kyungpook National University, Daegu, Korea, Republic of, good@knu.ac.kr, Seunghun Lee, Yongki Lee, Dongman Lee

Under the ubiquitous computing environment, the learner can use any device to exchange information with anyone anytime and anywhere. Based on the attitudes of ubiquity, the area of m-Learning systems has been developed by an increase in interactivity. Also the m-Learning technologies for wireless communication, network, and computation are each progressing at faster and faster rates. This fact will give rise to revolutionary applications. However, to make this vision a reality, many research challenges must be overcome. In this study, a research model is proposed to investigate the effectiveness of u-Learning content for university students. The model analysis was conducted using the multivariate analysis of variance procedure and multiple regression procedure.

2 - Using Impact Factor to Evaluate and Compare INFORMS Journals

Jeff Stonebraker, Assistant Professor, North Carolina State University, College of Management, Campus Box 7229, Raleigh, NC, 27695-7229, United States of America, jeff_Stonebraker@ncsu.edu

Identification of journals in which to publish is a critical function for academics. This paper builds on previous research that rated and ranked journals in OM/POM and uses the journal impact factor to compare INFORMS journals with other journals in the discipline. Our research provides insight as to the appropriateness of using the impact factor as a way to identify journals in which researchers in OR/MS might publish and assist academics in developing journal target lists.

3 - Risk Navigator SRM: A Ten-step Process for Strategic Risk Management

Jay Parsons, Colorado State University, 3226 Ledgestone Court, Fort Collins, CO, 80528, United States of America, jay.parsons@OptimalAg.com, Dana Hoag, Duane Griffith

A ten-step strategic risk management process has been developed to help agricultural producers and those who study agricultural production better assess and manage risk. A website has been developed (www.RiskNavigatorSRM.com) to explain the process and provide a suite of software tools to help people identify risks, assess their risk tolerance, identify and assess risk management alternatives, and implement strategies.

■ WA65

H-Room 202B, Second Floor

Inventory Models for Deteriorating Items

Contributed Session

Chair: Yang Tan, University of South Florida, 4502 Blue Tee Ct., Apt.201, Tampa, FL, 33613, United States of America, ytan@mail.usf.edu

1 - Blood Inventory Management with Protection Levels and Substitution

Ismail Civelek, PhD Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Tepper Business School, Pittsburgh, PA, 15213, United States of America, icivelek@andrew.cmu.edu, Alan Scheller-Wolf, Itir Karaesmen

We consider a discrete-time inventory system for a perishable item that has distinct demand streams for product of different ages (i.e. blood platelets). In addition to storage, outdating and shortage costs, we include substitution costs. We introduce the critical level policy to the perishable inventory literature, protecting the newest items against excessive downward substitution. We model the problem as MDP and evaluate the costs of a heuristic policy against existent near optimal policies.

2 - The Optimal Issuing Policy of a Perishable Blood Product: An MDP Approach

Rene Haijema, Dr, Wageningen University, Dep. Operations Research and Logistics, Hollandseweg 1, Wageningen, Netherlands, rene.haijema@wur.nl

The quality of blood platelet pools deteriorate over its lifespan of maximal 5 days. To meet the demand, pools of different ages are selected. Through a cost structure incentives are given to issuing young pools, but also outdating costs and costs for not meeting all demand apply. An optimal issuing policy is determined by solving a Markov Decision Problem. When state and action spaces are too large, aggregation and other tricks are applicable. The approach may improve transfusion practice.

3 - RFID Technology-based Model for Maximizing Value for Perishable Products

Yasaman Khodadadegan, PhD student, Arizona state University, 699 S. Mill Avenue #553, Tempe, AZ, 85281, United States of America, ykhodada@asu.edu, Ronald Askin, Moeed Haghnevis

Handling limited life time products known as perishable products is a challenge in logistics. Not only cost efficiency, but also a maximum quality level of products is significant. Radio Frequency Identification increases the ability of monitoring product shelf lives. We present an assignment problem that uses RFID system to monitor perishable items and maximize item values knowing their remaining shelf life. We develop an algorithm to solve the problem in reasonable amount of time.

4 - A Discrete-in-time Deteriorating Inventory Model with Time-varying Demand and Partial Backlogging

Yang Tan, University of South Florida, 4502 Blue Tee Ct., Apt.201, Tampa, FL, 33613, United States of America, ytan@mail.usf.edu

A finite planning horizon inventory system is considered for deteriorating items in which the demand is assumed to occur instantaneously at the end of each period, unsatisfied demands are partially backlogged depending on the waiting time, deterioration is assumed to be a variable fraction of the on hand inventory and time is treated as a discrete variable. Examples are given to illustrate the derived results.

■ WA66

H-Room 204A, Second Floor

Commodity Trading and Procurement

Sponsor: MSOM/ iFORM

Sponsored Session

Chair: Ankur Goel, Case Western Reserve University, 324 Peter B Lewis Building, 10900 Euclid Avenue, Cleveland, OH, 44113, United States of America

1 - Unit-Contingent Power Purchase Agreements: How Do We Manage Misreporting Behavior?

Owen Wu, Assistant Professor, Ross School of Business, University of Michigan, owenwu@umich, Volodymyr Babich

We study a unit-contingent power purchase agreement between an electricity distributor and a power plant, where the power plant's operational status is its private information and the plant may misreport its status. We answer the following questions: What type of misreporting under what circumstances could be beneficial to both parites? How much misreporting should be tolerated to maximize the benefit? How could such results be implemented in practice?

2 - Optimal Inventory Policies When Purchase Price and Demand are Stochastic

Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Peter Berling

We consider the problem of a firm that faces a stochastic demand (Poisson) and must replenish from a market in which prices fluctuate, such as a commodity market. Using the single-unit decomposition approach, we explicitly characterize the optimal base-stock level using a series of threshold prices. We show that the base-stock level is first increasing and then decreasing in the current purchase price, and obtain closed-form solutions when price follows a Geometric Brownian Motion.

3 - Procurement Risk Perceptions and Hedging in an Emerging Market

Cagri Haksoz, Assistant Professor of Operations Management, Sabanci University, Faculty of Management, Orhanli, Tuzla, Istanbul, 34956, Turkey, cagrihaksoz@sabanciUniversityedu

We study cross-industry survey data collected in Turkey to interpret the perceptions of professionals on procurement risk management. We employ ordered logit models to decipher the likelihood of operational and financial hedging and their main drivers. We show that hedging via multiple sourcing and financial derivatives are associated with drivers such as supplier and commodity market features, perceptions regarding the historical operational risk events and supply contract parameters.

■ WA67

H-Room 204B, Second Floor

Strategic Forecasting and Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Brian Lewis, VP Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

1 - Optimizing Business Strategy: Practical Issues and Lessons Learned

Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Strategic planning is a complex process that is not easily reduced to a form compatible with classic optimization techniques. We discuss the reasons why, as well as lessons learned from a recent project to develop a strategic forecasting and stochastic optimization solution that Novartis Vaccines & Diagnostics uses to optimize its drug investment activities.

2 - Herding Cats: The Art and Science of Assumption Management for Strategic Simulation Forecast Models

Michael Kubica, President, Applied Quantitative Sciences, Inc., 3100 North Ocean Blvd., Suite 1006, Ft. Lauderdale, FL, 33308, United States of America, mkubica@aqs-us.com

Effective strategic forecasting is predicated on assumptions representative of the risks and uncertainties faced in the forecasting effort. Assumption management is an iterative process requiring procedural rigor to ensure valid and reliable forecasts. The methods and tools utilized by AQS when constructing global simulation forecast models for some of the largest life sciences companies in the industry will be described. Examples specific to stochastic optimization models will be provided.

3 - Establishing Effective Metrics to Drive Consensus in R&D Planning

Phil Beccue, Director, Strategy & Portfolio Management, Baxter BioScience, One Baxter Way, Westlake Village, CA, 91362, United States of America, phil@beccue.com

Managing a dynamic R&D portfolio requires defensible asset valuations and clarity in identifying and balancing non-financial criteria important to the business. Both key metrics and strategic objectives have helped R&D leaders of a global pharmaceutical company grow their pipeline and meet their targets. In this case study, I will describe how we created and why we evolved a portfolio optimization process using appropriate segmentation, effective metrics, and disciplined prioritization schemes

4 - Making Strategic Operations Decisions at Hewlett-Packard

Gavin DeNyse, Hewlett-Packard, 4139 SW 55th Drive, Portland, OR, United States of America, gavin.denyse@hp.com

At HP, strategic operational decisions require trade-offs between multiple value measures that don't lend themselves to traditional optimization. HP's Strategic Planning & Modeling (SPaM) team uses a combination of DA tools for problem framing & spreadsheet modeling techniques to plot the efficient frontier of key value measures. An example from recent work will motivate the discussion & illustrate how the techniques are applied.

■ WA68

H-Room 206, Second Floor

Algorithms and Computations in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Yongpei Guan, Assistant Professor, Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - Interdicting a Maximum-Reliability Path Under Asymmetric Perception

Kelly Sullivan, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, kmsullivan@ufl.edu, Cole Smith

In the stochastic network interdiction problem, an evader seeks a maximum reliability path through a network while an interdictor places sensors in attempt to catch the evader. We consider a version of this problem, formulated by Morton et al. [IIE Trans 39 (2007), 3-14], in which the network is bipartite and the interdictor's perception of the network parameters differs from the evader's. We develop a class of facet-defining inequalities and a decomposition-based solution procedure.

2 - Application of the Discrete Moment Problem to an Insurance Problem

Munevver Subasi, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, msub@rutcor.rutgers.edu, Ersoy Subasi, Andras Prekopa

In insurance theory the claim process is generally described as a compound Poisson process, where the severity distribution is assumed to be of beta type. Typically, simulation is applied to find the probability distribution of the total claims. In this paper we show that the application of the discrete moment problem may produce very good approximation results.

3 - On Two-Stage Quadratic Integer Programs with Stochastic Right-Hand Side

Osman Ozaltin, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, ozaltn@yahoo.com, Oleg Prokopyev, Andrew Schaefer

We consider two-stage quadratic integer programs with stochastic right-hand sides. We give an equivalent reformulation using value functions of the first and second-stage problems. We provide implicit enumeration algorithms for finding the value function of quadratic integer programs parametrized for a family of right-hand sides. We solve the reformulation after obtaining the value functions using a global branch-and-bound approach. We also discuss minimal tenders for quadratic integer programs.

4 - Risk Averse Bidding in Two Settlement Electricity Markets

Aswin Kannan, Graduate Student, IESE, UIUC, 117 Transportation building, 104 S.Mathews Avenue, Urbana, IL, 61801, United States of America, akannan@illinois.edu, Uday Shanbhag, Kim Harrison

Existing models for two settlement markets do not provide wind-like uncertain generators with ex-ante incentives for maintaining grid reliability. By using CVaR measures, we construct a risk-averse generalized Nash equilibrium problem (GNE). Under both non-shared and shared risk measures, we show that the GNE is solvable. Numerical evidence on a model of the Belgian grid reveals that such models lead to equilibria that have markedly improved reliability when compared to classical designs.

■ WA69

H-Indigo A, Second Floor

Operations Management

Contributed Session

Chair: Soroosh Saghiri, PhD Student, University of Greenwich Business School, Park Row, Greenwich Campus, London, SE10 9LS, United Kingdom, s.saghiri@gre.ac.uk

1 - A Multiple Sourcing Model Under Demand and Supply Uncertainty

Jianli Hu, Chapman University, One University Dr., Orange, CA, 92620, United States of America, jhu@chapman.edu

We study a multiple a supplier selection and quantity allocation model using a two-stage supply chain consisting of N unreliable suppliers and one buying firm, where any given supplier either deliver everything ordered, or nothing. We develop the optimal ordering policies that minimize the total purchasing, holding, and penalty costs with backlogging. Our solutions reveal that cost generally takes precedence over reliability in the supplier selection process.

2 - An Empirical Study on the Operations and Marketing Interface in Service Industry

Taeho Park, Professor, San Jose State University, One Washington Square, San Jose, CA, 95192-0070, United States of America, park_t@cob.sjsu.edu, Ming Zhou, Minho Lee

Recent changes in the service business environment have required operations and marketing to be integrated more closely. Creation of the integrated and collaborative interface between those two functions has been reported as a challenging task, however is crucial to a firm's performance. Thus, this research studied through a survey on the impact of the communication and cooperation between the two functions on the operational performances of service firms.

3 - The Effects of Servitization Between Company's Alliance Announcement and the Market Value of Firms

Yoen Sung Yoo, Korea University, Anam-dong Seongbuk-Gu, Seoul, Business School, LSOM, Seoul, 136-701, Korea, Republic of, yooys@korea.ac.kr, Hosun Rhim

This paper analyzes the shareholder value effects of strategic alliance by measuring the stock market reaction associated with companies' alliance announcements. We investigate the impacts of servitization and productization by categorizing alliances. Sample consists of 100 companies by U.S corporations based on Fortune 100(2009).

4 - Service Competition: Which Customers are the Most Vulnerable

Ryan Buell, Doctoral Student, Harvard Business School, Morgan Hall 480, Boston, MA, 02163, United States of America, rbuell@hbs.edu, Dennis Campbell, Frances Frei

This paper empirically explores the effect of a competitive entrant's service level on the quantity and quality of an incumbent's customer relationships. We compare the behavior of customers of a nationwide retail bank across matched markets where entry did or did not occur and analyze the lagged effect of an entrant's service rating on the number, profitability and tenure of accounts served by the incumbent.

5 - Time Postponement Performance Measurement: A Study on Improving Delivery Lead Time

Soroosh Saghiri, PhD Student, University of Greenwich Business School, Park Row, Greenwich Campus, London, SE10 9LS, United Kingdom, s.saghiri@gre.ac.uk

In time postponement, some value adding activities are delayed by the time demand becomes clearer. Shortfall of time postponement is prolonging delivery lead time. To improve the performance of the postponement, this paper develops modified postponement models to postpone forecasting and shipment operations. Inventory and backlogs are defined as models performance criteria. Outcomes shows that modified postponement models have considerable improvement in performance criteria.

■ WA70

H-Indigo B, Second Floor

Green Supply Chain Management

Contributed Session

Chair: K. Jo Min, Iowa State University, Black Engineering 3012, Ames, IA, 50011, United States of America, jomin@iastate.edu

1 - Recent Developments on Dynamic Closed-loop Supply Chain

Pietro De Giovanni, PhD Candidate, Essec Business School, Avenue Bernard Hirsch, Cergy Pontoise Paris, 95801, France, pietro.degiovanni@essec.fr

This paper reviews the recent theoretical developments on closed-loop supply chain. Although environmental management should be investigated as dynamic phenomenon, most of the literature models mainly static games. This paper identifies the issues to be considered when modeling dynamic closed-loop supply chains while underlining the limitations obtained by previous static contributions.

2 - Preliminary Analysis of Reverse Logistics in Colombia

Ana Halabi, Doctoral Candidate, Universidad de la Sabana, Km 21 Autopista Norte, Chìa, 1234, Colombia, ana.halabi@unisabana.edu.co, Eugenio Corbacho, Juan J Aldaz, Marco T Alvarado, Carolina Pirachicàn, Jairo Montoya-Torres

The practice of reverse logistics is a critical part of a sustainable SCM strategy. However, there is little literature about this in Colombia. To overcome this gap, we present a research approach on RL practices in enterprises located in Bogota, Colombia. We develop a detailed statistical analysis of how RL practices in these enterprises impact both operational reverse logistics costs and marketplace opportunities, and what the barriers for implementing efficient RL strategies might be.

3 - Closed-loop Supply Chains under Governmental Incentives and Fees

K. Jo Min, Iowa State University, Black Engineering 3012, Ames, IA, 50011, United States of America, jomin@iastate.edu, Karla Valenzuela

We formulate and analyze a series of closed-loop supply chain models consisting of a manufacturer who manufactures/remanufactures a product, and a collector who collects used units of the product from customers and returns them to the manufacturer for remanufacturing. Under the framework of a Stackelberg game with governmental participation, we derive the equilibrium solutions, and assess the economic and environmental efficiencies measured in the total surplus and collection rate, respectively.

■ WA71

H-Indigo C, Second Floor

Supplier Selection

Contributed Session

Chair: Dincer Konur, Research Assistant, University of Florida, ISE Department 303 Weil Hall, Gainesville, FL, 32611, United States of America, dincer@ufl.edu

1 - Economic Lot-sizing Problem with Multi-mode Replenishment and Perishable Inventory

Sandra Eksioglu, Assistant Professor, Mississippi State University, PO Box 9542, Dept of Ind & Sys Engg, McCain Hall, Mississippi State, MS, 39762, United States of America, sde47@ise.msstate.edu, Shu Zhang

This study extends the classical economic lot-sizing problem to consider that several transportation modes are available to replenish perishable inventories. Inventory replenishment costs are represented by a multiple-setups cost function. Cargo capacity constraints are also considered. This problem is modeled as a network flow problem. A primal-dual algorithm is designed to identify the timing of an order, order size, and choice of transportation modes that minimize replenishment costs.

2 - A Two Stage Multiple Criteria-dynamic Programming Approach for Supplier Selection-order Allocation

Fereshteh Mafakheri, PhD Candidate, HEC Montreal, 3000 Côte-Sainte-Catherine Road, Montreal, Canada, fereshteh.mafakheri@hec.ca, MichËle Breton

This study introduces a two stage multiple criteria dynamic programming approach for supplier selection-order allocation, which are two of the most critical tasks in supply chain management. The proposed methodology stems from the need to address the involvement of several decision criteria in the first task and at the same time work with embedded dynamism in the latter.

3 - Reduction of Total Time in a Company by Applying Integer Programming with Binary Decision Variables

Jose Perez, Arizona State University, P.O. Box 878809 Tempe, AZ 85287-8809, Tempe, United States of America, jose.perezbecerra@asu.edu

The situation is this: a workshop within a supply chain has the need of optimizing the total time of doing jobs in its machines. We demonstrate that we the use of an integer program with binary decision variables, this total time can be reduced dramatically, improving the perfomance of the company and generating savings of around $100,000 per year.

4 - Supplier Selection under Varying Replenishment Cost Structures

Dincer Konur, Research Assistant, University of Florida, ISE Department 303 Weil Hall, Gainesville, FL, 32611, United States of America, dincer@ufl.edu, Aysegül Toptal

In this study, we analyze the supplier selection problem of a company with the objective of minimizing expected inventory related costs. Suppliers in this setting may have varying retail price structures and may utilize different modes of transportation in the outbound. We solve the supplier selection problem of the company which, as a result, faces a cost structure involving a combination of all-units discounts with economies and diseconomies of scale, and stepwise freight costs.

■ WA72

H-Indigo D, Second Floor

Artificial Intelligence/Neural Networks

Contributed Session

Chair: Menkes van den Briel, University of Colorado, 995 Regent Drive, Boulder, CO, 80309-0419, United States of America, vandenbr@colorado.edu

1 - Dynamic Capacity Planning Using Bass and Markowitz Model in Agent Based Supply Chain

Saman Alaniazar, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, dv2663@wayne.edu, Ratna Babu Chinnam, Alper Murat

We design an agent to facilitate capacity planning in supply chains supporting new product introductions. Given the non-stationary nature of demand, the agent employs a hybrid-strategy of short-term demand forecasting for incremental capacity expansion and long-term demand modeling based on the Bass diffusion model for termination of expansion process. The agent is improving the decisions in each product launch. We report experimental results based on the Tamagotchi Case.

2 - Evaluation of Tile and Ceramic Companyís Knowledge Management Using Fuzzy AHP

Gholamreza Khoshsima, Instructor, Vali-e-Asr University of Rafsanjan, Department of Management, Rafsanjan, Ke, 518, Iran, gholamreza.khoshsima@gmail.com, Mehdi Ebrahiminejad

The paper presents application of the FAHP that is used to weight CSFs and evaluate tile and ceramic company's KM level. This method adopts a multi-criteria approach that can be used to analyze and compare aspects of KM in the tile and ceramic market. An FAHP model is formulated and applied to a real case of assisting decision-makers in a leading tile and ceramic company in Iran to evaluate a suitable KM implementation.

3 - Optimal Automated Planning

Menkes van den Briel, University of Colorado, 995 Regent Drive, Boulder, CO, 80309-0419, United States of America, vandenbr@colorado.edu, Thomas Vossen

Automated planning is an area in artificial intelligence that aims at generating plans that lead to some desired outcome. Automated planning in its classical form is PSPACE-complete, yet we investigate an approach for generating optimal plans. Central to our procedure is the notion of composition. Starting with a decomposition of the planning problem, we use re-composition to generate strong valid inequalities. Initial results are promising and show the potential of our approach.

■ WA73

H-Indigo E, Second Floor

Analysis of Queueing Models I

Contributed Session

Chair: Joe Lake, R & D 1, ORNL, 1 Bethel Valley Road, MS 6085, Oak RIdge, TN, 37831, United States of America, lakeje@ornl.gov

1 - Using Little's Law to Derive the Time-dependent Moments of Queueing Systems

Brian Fralix, Assistant Professor, Department of Mathematical Sciences, Clemson University, Martin Hall, Clemson, SC, United States of America, bfralix@clemson.edu

We discuss a transient interpretation of Little's law, and we use it to give a probabilistic description of all of the transient moments of a regulated Brownian Motion, and a reflected Ornstein-Uhlenbeck process, for any initial condition.

2 - Three-moment Four-parameter Decomposition Approximation of Queueing Networks: Modeling Correlations

Sunkyo Kim, Associate professor, Ajou University, San 5, Woncheon-dong, Suwon, Korea, Republic of, sunkyo@ajou.ac.kr

We propose an extension of the innovations method developed to capture correlations between split streams in two-moment parametric decomposition approximation of open queueing networks. We generalize the innovations to determine correlations in third moment of split streams and merged streams. We show that MMPP(2) approximation of arrival process performs better with correlations accounted for in both second and third moment.

3 - Approximation of Non-stationary Service Systems with Retrials

Raik Stolletz, Technical University of Denmark, Produktionstorvet 424, Lyngby, 2800 Kgs., Denmark, raist@man.dtu.dk

This presentation proposes the Stationary Backlog-Carryover (SBC)approach for the time-dependent analysis of stochastic and non-stationary queueing systems with retrials. The analysis of a series of stationary queueing models leads to a new approximation of time-dependent performance measures. Beside the main idea of this approach, we present applications for different service systems, for example call centers. Numerical experiments demonstrate the reliability of the SBC approach.

4 - A State-dependent Model for Sojourn Time in Multi-server Queueing Networks

Hyun Ho Kim, Auburn University, Department of Industrial and Systems Eng, Auburn, AL, 36849, United States of America, kimhyuh@auburn.edu, Kevin Gue

We develop an approximation model for the state-dependent sojourn time distribution of customers or orders in multi-server queues with general interarrival time and service time distributions. The model uses phase-type distributions and a Markov process to model the all-busy period for the waiting time distribution.

5 - Capacity Utilization Study for Aviation Security Cargo Inspection Queuing System

Joe Lake, R & D 1, ORNL, 1 Bethel Valley Road, MS 6085, Oak RIdge, TN, 37831, United States of America, lakeje@ornl.gov, Daryl Brumback, Glenn Allgood, Mohammed Olama, Terri Rose

For this paper, capacity utilization, subscribed capacity utilization, resources capacity utilization, and subscribed resources capacity utilization studies as performance measures for an aviation security cargo inspection system are presented. The increased physical understanding resulting from execution of the queuing model utilizing these vetted performance measures will reduce the overall cost and shipping delays associated with new inspection requirements.

■ WA74

H-Indigo H, Second Floor

Life Testing in Reliability

Contributed Session

Chair: Nasser Fard, Associate Professor, Northeastern University, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, n.fard@neu.edu

1 - Proportional Hazards Model in Step-stress Accelerated Life Test

Chenhua Li, Research Associate, Department of Industrial and Systems Engineering, Texas A&M University, TAMU-3131, College Station, TX, 77843, United States of America, Chenhual@tamu.edu, Nasser Fard

Step-stress accelerated life tests (SSALT), where stress is increased in a discrete sequence, are used to induce early failures of highly reliable products. In this research, we focus on proportional hazards (PH) model in SSALT. The baseline intensity function is defined at the highest stress levels to obtain an initial estimate of the parameters. PH model is assumed for all other stress levels. Multiple SSALT design is considered and the optimal stress change times for each step are obtained.

2 - Heuristic for Test Plan Optimization

Elsayed Elsayed, Professor, Rutgers University, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu, Michael Koskulics

Multiple-stress ALTs have been employed as a means of accelerating failures of units to predict reliability at normal conditions. Accurate extrapolations from these ALTs require an optimal allocation of testing units to different stress combinations. In this presentation, we discuss an heuristic that determines the optimum number of stress combinations, stress levels, and the number of test units allocated to each stress combination. Numerical example is provided.

3 - Equivalent Multi-stress Accelerated Life Testing Plans

Elsayed Elsayed, Professor, Rutgers University, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu, Yada Zhu

As product life may depend on several stresses operating simultaneously, ALT with multiple stresses is a realistic and feasible way for reliability prediction. In this work, we develop optimal multi-stress ALT testing plans involving different stress applications and censoring types, and its equivalency to the baseline multi-constant-stress test. The equivalent test facilitates reducing the test time and/or number of test units remarkably while maintaining the same level accuracy of reliability prediction.

4 - Acclerated Methods in Life Testing

Nasser Fard, Associate Professor, Northeastern University, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, n.fard@neu.edu

Accelerated life testing (ALT) is designed to test prototype units or a small quantity of a product sample under higher than normal operating stress levels. In Step-stress accelerated life testing (SSALT), the stresses are subject to change at some points during the test interval. The stress levels are increased for the survival units, either based on the test duration or based on the number of failures during a test.

Wednesday, 11:00am - 12:30pm

■ WB01

C-Room 21, Upper Level

DA in Oil & Gas II

Sponsor: Decision Analysis

Sponsored Session

Chair: Reidar Bratvold, University of Stavanger, Department of Petroleum Engineering, Stavanger, 4036, Norway, reidar.bratvold@uis.no

1 - Volatility Estimation for Stochastic Project Value Models

Joe Hahn, Pepperdine University, Graziadio School of Business and Managem, Joe.Hahn@pepperdine.edu, Luiz E. Brandao, James Dyer

A single variable stochastic process, in the form of a discrete model of project value, was proposed as the underlying uncertainty for real option problems in the methodology of Copeland and Antikarov (2001). This approach offers increased flexibility, including the ability to accommodate multiple sources of uncertainty, compound options, and offers the potential to solve complex problems. However, project volatility, one of the most critical parameters of the stochastic project value model, is systematically overstated by the existing estimation methods, leading to option values that are higher than they should be. In this article, we derive an unbiased alternative approach which confirms empirical work by Brandao, Dyer and Hahn (2005b) and Godinho (2006). We then apply our method to a hypothetical project and compare to the results from the existing approaches.

2 - Bayesian Decision Networks for Drilling Decision Support

Reidar Bratvold, University of Stavanger, Department of Petroleum Engineering, Stavanger, 4036, Norway, reidar.bratvold@uis.no, Mohamad A Rajaieyamchee

Today's decision makers in the oil and gas industry are faced with remarkable new technologies, huge amounts of information to help them make high-quality decisions, and the ability to share information at unprecedented speeds and quantities. In this talk we illustrate the use of Bayesian Decision Networks (BDN) to structure drilling decision problems, show the relevance between the key uncertainties and decisions, and consistently update information with the arrival of new data. The BDN provides a methodology for robust (in both the conceptual framework and algorithm performance) decision support in the drilling operations

■ WB02

C-Room 22, Upper Level

Panel Discussion: Lessons Learned from using Experts in DA/RA Studies

Sponsor: Decision Analysis
Sponsored Session

Chair: Jason Merrick, Associate Professor, Virginia Commonwealth University, Richmond, VA, 23084, jrmerric@vcu.edu

1 - Lessons Learned From Using Experts in DA/RA Studies
Moderator: Jason Merrick, Associate Professor, Virginia Commonwealth University, Richmond, VA, 23084, jrmerric@vcu.edu, Panelists: Elisabeth Pate-Cornell, Greg Parnell, Jack Kloeber

Panelist will share their best and worst experiences using experts in various decision and risk analysis studies. Panelist will be asked additional questions including their thoughts on "expert creep" and the applicability of expert assessment for today's homeland security challenges. The session will conclude by generating a list of lessons learned.

■ WB03

C-Room 23A, Upper Level

Multiobjective Optimization: Methods and Applications

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Altannar Chinchuluun, Dr., University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, altannar@ufl.edu

Co-Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

1 - Strategic Business Process Planning in a Health-Care System: An MCDM Case Study
N. K. Kwak, Professor, Saint Louis University, John Cook School of Business, St. Louis, MO, 63108, United States of America, kwakn@slu.edu, Chang Won Lee

This study deals with business process planning (BPP) in a health-care system using an MCDM model. The model is developed and analyzed based on the data obtained from a hospital. Goal criteria and priorities are identified and established using the AHP. GP is utilized to derive satisfying solutions for BPP. The model results are evaluated and sensitivity analyses are performed. The case study provides the management with valuable information for planning health-care activities and services.

2 - Foundations of Intelligent Knowledge Management
Yong Shi, Dr., College of Information Science and Technology, University of Nebraska at Omaha, Omaha, NE, 68182, United States of America, yshi@mail.unomaha.edu

Knowledge discovered by data mining from large-scale databases has great novelty, which is often unable to be gained from the experts. The challenging problem, however, is that if the results of data mining can be really regarded as 'knowledge'. To answer this problem, the theory of knowledge management should be applied. The purpose of this paper is to bridge the fields of data mining and knowledge management based on large-scale databases.

3 - Minimax Theorems for Vector-valued Set-valued Mappings
Pando Georgiev, University of Florida, Center for Applied Optimization, Gainesville, FL, 32611, United States of America, pandogeorgiev@gmail.com

Several minimax theorems for multifunctions in ordered Banach spaces are presented. They generalize the classical minimax theorems for the scalar case. The main tool for proving them is a variant of Ky Fan's inequality of mixed kind for vector-valued multifunctions, which has an independent interest.

4 - The Order Planning Method of Steel Factory based on the MTO-MTS Management Architecture
Qipeng Zheng, PhD Student, University of Florida, Department ISE, Weil 303, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, zqp@ufl.edu

Models of order planning method for steel factory based on the MTO-MTS management architecture are proposed in this talk. In order to synchronize inventory and production capacity and maximize the utilization of equipments in the order planning processes for steel factories, multiple objectives are considered in these models. Algorithms based on multi-objective optimization are proposed to solve the models.

■ WB05

C-Room 23C, Upper Level

Operations and Management in Energy Industry II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Eunshin Byon, Texas A&M Universtiy, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@neo.tamu.edu

1 - U.S. Power Grids: Evaluating and Mitigating Vulnerability to Terrorist Attack
Kevin Wood, Professor, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, kwood@nps.edu, Javier Salmeron

Algorithms based on global Benders decomposition are used to evaluate the vulnerability to terrorist attack of certain regional power grids in the U.S., or to plan the grids' defenses. We can answer the following type of question in a few minutes: "Which set of substations or generators are most critical to system functionality?"; we can answer this in a few hours: "Given a limited defense budget, which components are most important to protect?"

2 - Advanced Analytics for the Smart Grid
Jeremy Bloom, Optimzation Product Marketing Manager, ILOG, an IBM Company, 1195 West Fremont Ave., Sunnyvale, CA, 94087, United States of America, bloomj@us.ibm.com

Power systems of the future will require decision-making fundamentally different than current modes: it will need to be faster, decentralized, and deal with uncertainty. These differences will require fundamentally different ways of forecasting that are closely integrated with the decision-making process. This presentation discusses how advanced analytics can address these issues, particularly regarding the Smart Grid. It will also provide some insights about important research topics.

3 - Detecting Unusual Behavior in Power Consumption Time Series Using SPC-based Strategies
Jose Luis Ribeiro, Dr., UFRGS, Av. Osvaldo Aranha 99, 5o Andar, Porto Alegre, Brazil, ribeiro@producao.ufrgs.br, Flavio Fogliatto

This paper presents a Statistical Process Control (SPC)-based strategy for detecting unusual behavior in power consumption time series. The proposed strategy combines an easily implementable forecasting model to predict demand, with expert and SPC rules. The combined use of robust statistics and SPC rules allows the efficient detection of unusual behavior. The proposed strategy is illustrated in a case study using a large dataset from an electricity distributor located in southern Brazil.

4 - Modeling and Simulation of Wind Farm Maintenance Operations in DEVS
Eduardo Perez, Graduate Student, Texas A & M University, 3131 TAMU, College Station, TX, United States of America, eduardopr@neo.tamu.edu, Eunshin Byon, Lewis Ntaimo, Yu Ding

Wind turbines suffer from stochastic loading due the seasonal variation of wind speeds which makes their degradation and failure prediction rather complex. Most of the existing maintenance optimization models are based on stationary conditions. We present a discrete event system specification (DEVS) modeling and simulation approach for predicting wind turbine states and for assessing wind farm maintenance decisions. Simulation results based on a realistic wind farm will be presented.

■ WB06

C-Room 24A, Upper Level

Prognostics/Health Management, Sensors, and RFID II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Abe Zeid, Northeastern University, Boston, Massachusetts, zeid@coe.neu.edu

Co-Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

1 - Sensitivity Analysis and Comparison of Algorithms in Maintenance and Replacement Scheduling
Kamran Moghaddam, PhD Candidate, University of Louisville, Department of Industrial Engineering, Department of Industrial Engineering, University of Louisville, Louisville, KY, 40292, United States of America, ksmogh01@louisville.edu, John Usher

we present experimental results of a sensitivity analysis on preventive maintenance and replacement scheduling optimization models in multi-component systems. Two factorial design experiments based on the cost

associated with maintenance and replacement activities and reliability characteristic parameters are constructed and analyzed. We also design a comprehensive experiment to analyze and compare the efficiency and accuracy of the exact and heuristic algorithms and show the advantages of each.

2 - A Conditioned-based Imperfect Maintenance Model with Action Dependent Deterioration

Thomas Yeung, Assistant Professor, Ecole des Mines de Nantes, 4 Rue Alfred Kastler, Nantes, 44307, France, thomas.yeung@emn.fr, Mariem Zouch, Bruno Castanier

We propose an imperfect maintenance optimization model where the state of the system is based on a percentage of total degradation and the rate of change of the degradation. We consider that the rate of degradation after imperfect maintenance will be altered based on the action performed and the state of the system prior to the maintenance. We formulate the model as a Markov decision process and motivate the problem through road maintenance.

3 - Data-Driven Reliability Estimation for Prognostics and Health Management (PHM)

Aparna Huzurbazar, Statistical Sciences Group, Los Alamos National Laboratory, MS F 600, Los Alamos, NM, 87545, United States of America, aparna@lanl.gov

PHM is increasingly important for understanding and managing today's complex systems. PHM develops the capability to make decisions about maintenance, based on prognostics information, resources, and operational conditions. This talk will present background on PHM along with a suite of applicable statistical tools and methods. Our primary application of PHM is to predict the future life of the system using data from a variety of sources such as vibration, degradation, and so on.

■ WB07

C-Room 24B, Upper Level

System Informatics and Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706-1572, United States of America, szhou@engr.wisc.edu

Co-Chair: Li Zeng, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, LZENG1@WISC.EDU

1 - Simulation-Based Cycle Time Quantile Regression on System Throughputs

Nan Chen, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53705, United States of America, nchen3@wisc.edu, Shiyu Zhou

The cycle time is an important performance measure in manufacturing systems, and thus it is of interest to characterize its distributional properties, such as quantiles, for informative decision making. In this paper, we propose a nonlinear quantile regression model to investigate the relationship between stationary cycle time quantiles and corresponding system throughput rates. Extensive numerical studies are presented to demonstrate the effectiveness of our methods.

2 - Achieving Low Within-wafer Variability in Semi-conductor Manufacturing Process

Hyun-Jin Kim, POSTECH, Nam-Gu Hyoja-Dong, Po-Hang, KB, Korea, Republic of, brightst@postech.ac.kr, Kwang-Jae Kim, Doh-Soon Kwak

A semi-conductor manufacturing process produces approximately 400 chips in a single wafer. The chips at different locations of a wafer are not of the same quality, due to some fixed effect by the location. This research aims to optimize a semi-conductor manufacturing process by finding the optimal setting of the input variables which minimizes the fixed effect while keeping the overall quality at some desirable level.

3 - Reconfigured Piecewise Linear Regression Tree for Multistage Manufacturing Process Control

Ran Jin, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, GA, 30332, United States of America, jinr@gatech.edu, Jianjun Shi

The modeling for process control is important for quality improvement in multistage manufacturing processes. However, methodologies based on linear models may not be adequate to describe the non-linear relationship of variables. This paper proposes the reconfiguration of piecewise linear regression trees to model the variation propagation. A feedforward control strategy is developed for variation reduction. A case study in a wafer manufacturing process is used to illustrate the procedure.

■ WB08

C-Room 24C, Upper Level

Special Topics in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Refik Soyer, George Washington University, 2201 G Street NW, Funger Hall 415, School of Business, Washington, DC, 20052, United States of America, soyer@gwu.edu

1 - Product Promotion Optimization Using Bayesian Networks

Srinivas Prasad, The George Washington University, 415 Funger Hall, Washington, DC, United States of America, prasad@gwu.edu

We propose models for optimizing product promotion decisions that arise in many retail settings. The models are based on incorporating promotion effects that are estimated using Bayesian networks constructed from past purchase data.

2 - Bayesian Queuing Models for Call Centers

Tevfik Aktekin, PhD Candidate, The George Washington University, 2115 G Street, NW, Monroe Hall Suite 403, Washington, DC, 20052, taktekin@gwu.edu

Queuing models have been extensively used in call center analysis for obtaining performance measures and for developing staffing policies.However, almost all of this work have been from a pure probabilistic point of view and have not addressed issues of statistical inference.In this paper,we develop Bayesian analysis of call center queuing models.We consider models with both patient and impatient customers, present relevant operating characteristics and discuss further extensions.

3 - Are You Finding the Right Person? A Name Translation System

Yilu Zhou, George Washington University, 2201 G St Suite 515, Washington, DC, 20052, United States of America, yzhou@gwu.edu

Searching for proper names in foreign language is an important task in multilingual search. However, name translation is the most difficult to handle because they are often unknown words with great variations. We propose an interactive name translation and search system: NameTran, which translates English names into Chinese using a hybrid Hidden Markov Model-based transliteration and a web mining model. We also demonstrated the feasibility of incorporating user ranking to improve the model.

4 - Bayesian Computations in Call Center Arrival Modeling

Refik Soyer, George Washington University, 2201 G Street NW, Funger Hall 415, School of Business, Washington, DC, 20052, United States of America, soyer@gwu.edu, Tevfik Aktekin

We consider Bayesian models for within day and inter day correlations for call arrivals. We develop MCMC methods for analysis of the models. Implementation is illustrated using actual call center data.

■ WB09

C-Room 25A, Upper Level

Scheduling: Performance and Optimization

Sponsor: Applied Probability
Sponsored Session

Chair: Bert Zwart, CWI, Amsterdam, Netherlands, Bert.Zwart@cwi.nl

1 - Optimal Resource Allocation of Time-reservation Systems

Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl, Rob van der Mei

We study the optimal resource allocation in time-reservation systems. A decision maker simultaneously has to decide on how many processors to allocate such that reservation and holding costs are minimized. We show via dynamic programming that the optimal number of processors follows a step function with as extreme policy the bang-bang control.

2 - Optimal Scheduling Policies for the Limited Processor Sharing Queue

Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl

We study a limited processor sharing queue (LPS with Poisson arrivals and phase type service times. The processor can admit a limited number of requests for service. We present a new decomposition-based approach to analyze monotonicity properties that lead to a complete characterization for the optimal scheduling policy providing new fundamental insights into the optimal control of LPS queues. The results show that a considerable gain can be obtained by using the dynamic policy.

3 - Heavy-traffic Analysis of Mean Response Time under Shortest Remaining Processing Time

Minghong Lin, Caltech, Einstein Drive 316, Pasadena, United States of America, mhlin@caltech.edu

SRPT has long been known to optimize the queue length distribution and the mean response time. As such, it has been the focus of a wide body of analysis. However, results about the heavy-traffic behavior of SRPT have only recently started to emerge and hold only under specific workloads. In this work, we characterize the heavy traffic behavior of mean response time of SPRT under general job size distributions. Further, we apply the results to analyze SRPT in load balancing systems.

4 - Competitive Scheduling and Large Deviations

Bert Zwart, CWI, Amsterdam, Netherlands, Bert.Zwart@cwi.nl

In a large deviations setting, FIFO is optimal for light-tailed service times, and service disciplines such as PS and SRPT are optimal for heavy-tailed service times. Additionally, PS and SRPT do not perform well for light-tailed service times, while FIFO does not perform well for heavy-tailed service times. We answer the natural question whether it is possible to construct a single scheduling discipline that is optimal for both light tailed and heavy tailed service times.

■ WB10

C-Room 25B, Upper Level

Risk Analysis

Contributed Session

Chair: Stefan Creemers, Dr., K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, stefan.creemers@econ.kuleuven.be

1 - Quantile Estimation by Bootstrapping for a Contact Costing Model

Berrak Dag, Research Postgraduate, University of Limerick, ER 1-030 Enterprise Research Centre, University of Limerick, Limerick, Ireland, berrakdag@yahoo.com, Paul Liston, Cathal Heavey

Quantiles are useful for risk analysis in supply contracts. However, estimation of quantiles is not easy. This study investigates the use of bootstrapping to estimate the quantiles of profit from a contract costing simulation model. This model examines the cost drivers in a typical outsourced manufacturing supply chain from the point of view of a contract manufacturer. It is observed that bootstrapping can provide more accurate results within a shorter timeframe in comparison with other methods.

2 - A Risk-based Critical Asset Identification Platform Within an Automated Power Grid

Farnaz Farzan, Rutgers The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, farnazfn@gmail.com, Mohsen Jafari, Ali Z. Rezvani, Zahra Mohajerani

Automated control schemes within a power grid results in a grid which is an elaborate collection of assets. Protecting such grid against cyber attack is vital and subjected to limited monetary resources. In this work a risk-based critical asset identification model which provides cyber risk measure is developed. Risk measure takes into account the vulnerability of an asset, the physical impact of a cyber attack and the costs associated with it. The model runs both at grid and substation levels.

3 - An Integrated Risk Analysis Methodology for Construction Projects

Stefan Creemers, Dr., K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, stefan.creemers@econ.kuleuven.be, Filip Deblaere, Erik Demeulemeester, Willy Herroelen, Stijn Van de Vonder

Activities in construction projects are subject to numerous risks that may affect their duration. The activity durations may be influenced by weather delay, faulty estimation of work content ... We propose a methodology for estimating the probability and the impact of these risks, as well as the incorporation of these risks into activity duration distributions. The methodology has been implemented in a software tool and has been tested in collaboration with the Belgium construction industry.

■ WB11

C-Room 25C, Upper Level

Data Mining in Health Care and Biology

Contributed Session

Chair: Saylisse Davila, Arizona State University, 151 E Broadway Rd #210, Tempe, AZ, 85282, United States of America, saylisse@asu.edu

1 - Understanding Genomic, Transcriptomic and Proteomics Data Using Gradient Boosted Trees

Wandaliz Torres Garcia, PhD Student, Arizona State University, P.O. Box 875906, Tempe, 85287-5906, United States of America, wandaliz@asu.edu, George Runger

Gradient Boosted Trees was used to unravel possible nonlinear relationships between transcriptomic and proteomic data, and to predict abundance for the undetected proteins based on relevant features such as mRNA abundance, cellular role, molecular weight, sequence and protein length, GC content and genomic sequence counts. Our findings support the known correlation of mRNA and protein abundances and external biological knowledge was used to validate the prediction for the undetected proteins.

2 - High-dimensional Surveillance

Saylisse Davila, Arizona State University, 151 E Broadway Rd. #210, Tempe, AZ, 85282, United States of America, saylisse@asu.edu, Eugene Tuv, George Runger

The increase over time of a specified event within a population is a common problem that occurs in disciplines such as economics, process control, as well as in public healthcare. An important scenario requires detecting disease clusters in a covariate space defined by patient-level characteristics (such as age, sex, etc.) as well as spatiotemporal attributes. We present new methods to address this problem.

■ WB12

C-Room 26A, Upper Level

Applications to OR

Contributed Session

Chair: Suman Niranjan, Assistant Professor, SUNY-Binghamton, Academic A # 279, School of Management, 4400 Vestal Pwy East, Binghamton, NY, 13902, United States of America, sniranja@binghamton.edu

1 - Optimal Prices and Loyalty Discounts for Tiered Reward Programs

Saeed Zolfaghari, Department of Mechanical and Industrial Engineering, Ryerson University, 350 Victoria Street, Toronto, ON, Canada, zolfaghari@ryerson.ca, Amir Gandomi-Sereshki

In this study, a mathematical model is developed to find the optimal prices and loyalty discounts for a tiered reward program. In such a program, customers' loyalty reward depends on the number of periods they make a purchase; the more frequent they buy, the higher loyalty discount they get.

2 - Optimal Pricing and Inventory Policies in TAC SCM Using Stochastic Dynamic Programming

Soheil Sibdari, University of Massachusetts Dartmouth, 285 Old Westport Road, North Dartmouth, MA, 02747, United States of America, ssibdari@umassd.edu, Xiaoqin Zhang

We present an effective pricing and inventory policies based on a stochastic dynamic programming technique for the Trading Agent Competition in Supply Chain Management Game (TAC SCM). One of the inherent sub-problems is deciding about accepting the bids and their prices in each period. We estimate the parameters and applied our method to an instance of the problem. We report a significant profit improvement compared to the current method and few other simple heuristics.

3 - Server Sharing Decisions in Field Services with Multiple Territories

Suman Niranjan, Assistant Professor, SUNY-Binghamton, Academic A # 279, School of Management, 4400 Vestal Pwy East, Binghamton, NY, 13902, United States of America, sniranja@binghamton.edu, Saligrama Agnihothri

In this paper we consider a field service system with two territories, a dedicated server assigned to each territory. We assume that whenever a server is dispatched to a customer in a different territory, an additional travel time is incurred. We use simulation to investigate the conditions under which complete sharing, partial sharing, and no sharing is optimal.

■ WB13

C-Room 26B, Upper Level

CP Technology

Sponsor: Computing Society
Sponsored Session

Chair: Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

1 - Domain Filtering for the Intersection of Set Variables

Willem-Jan van Hoeve, Assistant Professor of Operations Research, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, vanhoeve@andrew.cmu.edu, Ashish Sabharwal

Many combinatorial problems can be conveniently expressed using set variables and constraints over these variables. The structure captured by the set variable representation can be exploited in domain filtering algorithms for constraint programming. We present the first polynomial-time (subset-)bounds consistency algorithm for the atmost1 constraint on pairs of set variables, which can be used, e.g., in sport scheduling applications. Computational results show the effectiveness of our algorithm.

2 - Evaluation of the Length-Lex Domain for Set Variables

Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

The talk reviews the length-lex domain for set variables in constraint programming. The domain orders sets first by cardinality and then lexicographically. We review constraint-propagation algorithms for set variables using this domain and presents experimental results demonstrating the effectiveness of the domain.

■ WB14

C-Room 27A, Upper Level

New Algorithms for Convex Cone Programming

Sponsor: Computing Society
Sponsored Session

Chair: Miguel Anjos, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, manjos@uwaterloo.ca

1 - HIPCUT I - Background and Theory

Miguel Anjos, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, manjos@uwaterloo.ca, Alexander Engau, Anthony Vannelli

This is the first of two talks to present our recent progress with a hybrid interior-point cutting-plane method (HIPCUT) for the solution of conic convex programming relaxations of combinatorial optimization problems. The method integrates a cutting-plane scheme within an interior-point method that identifies relevant cuts dynamically as inherent part of the algorithm. We provide its theoretical background that stems from a successful use of feasibility indicators for interior-point warm starts.

2 - HIPCUT II - Algorithm and Applications

Alexander Engau, Assistant Professor, University of Colorado Denver, Mathematical and Statistical Sciences, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, aengau@alumni.clemson.edu, Anthony Vannelli, Miguel Anjos

This is the second of two talks to present our recent progress with a hybrid interior-point cutting-plane method (HIPCUT) for the solution of conic convex programming relaxations of combinatorial optimization problems. Assuming the theoretical background provided in the first talk, we focus on the underlying algorithm and describe some details of its implementation. We conclude with several applications of HIPCUT to spin-glass problems from statistical physics and single-row facility-layout.

3 - A Smoothing Technique for a Class of Large-Scale LPs

Jieqiu Chen, University of Iowa, Iowa City, 52242, United States of America, jieqiu-chen@uiowa.edu, Sam Burer

We investigate a smoothing technique to solve large-scale instances of a class of LPs that arise from machine learning context. When applied to our problem, Nesterov's smoothing technique requires a parameter that bounds the optimal value from above. We design a scheme that dynamically updates the parameter to speed up the convergence. We will discuss the computational results of applying our technique to solve large-scale 1-norm SVM problems that cannot be solved by off-the-shelf LP solvers.

■ WB16

C-Room 28A, Upper Level

Joint Session IS/eBusiness: E-commerce Strategy and Mechanism Design

Sponsor: Information Systems & eBusiness
Sponsored Session

Chair: Jane Feng, Assistant Professor, University of Florida, 360 Stuzin Hall, Gainesville, FL, 32611, United States of America, jane.feng@cba.ufl.edu

1 - Online and Local Competition on Brick-and-mortar Businesses: Evidence From the Banking Industry

Bin Gu, Assistant Professor, University of Texas at Austin, 2100 Speedway B6500, Austin, United States of America, bin.gu@mccombs.utexas.edu, Mei Xue, Lorin Hitt

This study assesses the relative influence and significance of online competition and local competition on brick-and-mortar businesses. Using a panel data on individual customer depository balance from a major US bank, we find that competition from online banks presents a significant threat to the brick-and-mortar bank, while local competition has little influence. We also find that some of the strategies used by the brick-and-mortar bank significantly moderate the competition.

2 - Relational Contracts and Reputation Mechanisms

Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu, Lan Shi

We examine the form of procurement contracts with the possibility of repeated relationships in the market for outsourced information technology services. At intermediate interest rates, the form of procurement contract affects the parties reneging temptation on a given relational contract, and hence affects the best relational contract that is sustainable. Second, complexity becomes relatively less important in the choice between fixed-price versus cost-plus contracts.

3 - Practicing Partial Resale on the Internet: Scalping, Resale Structure, and Firm Profit

Xianjun Geng, Assistant Professor, UT Dallas, School of Management, 800 W. Campbell Rd., Dallas, 75080, United States of America, gengxj@gmail.com, Ruhai Wu, Andrew Whinston

Partial resale refers to the business scenario where some resale activities, yet not all, are feasible. We present two findings related to partial resale in this paper. We first show that the existence of scalping on the Internet does not reduce the benefit of partial resale to a seller. We then consider three alternative structures of partial resale and show firm profits are the same across all three alternatives.

■ WB17

C-Room 28B, Upper Level

E-Business/Commerce I

Contributed Session

Chair: Zsolt Ugray, Assistant Professor, USU, 3515 Old Main Hill, Logan, UT, 84322-3515, United States of America, zsolt.ugray@usu.edu

1 - Optimizing Online Ads in Social Networking Websites: A Case Study of Facebook

Arash Farsi, Student, Carnegie Mellon University, 301 N Neville St, Apt 3B, Pittsburgh, PA, 15213, United States of America, afarsi@andrew.cmu.edu

Based on a survey of Facebook users, we try to determine the impact of online ads in the social networking website. We focus on the key factors that could increase the chance that users would click on online ads presented to them.

2 - Trust Enhancing "IT-signals" in e-tailing: An Empirical Study Based on a Structural Equation Model

Dennis Ahrholdt, University of Hamburg - Insitute of Operations Research, Von-Melle-Park 5, Hamburg, 20146, Germany, Dennis.Ahrholdt@uni-hamburg.de

A structural equation model based on the Theory of Planned Behavior will be presented which, under consideration of the complex demands of reality, focuses on the identification and efficiency-evaluation of success-enhancing webdesign elements. The computation based on empirical data with Partial Least Squares shows that many webdesign elements have signalling character but different trustworthiness belief-altering potentials' which in turn effect the trust-based intention to transact.

3 - How Much to Blog

Jan Edman, Asst. Professor, Stockholm School of Economics, Sveav 65, Stockholm, 11383, Sweden, jan.edman@hhs.se

Blogging is currently a popular activity. In business, reasons to blog include to provide commentary on a topic, and to form and maintain a community forum. One would expect that the benefits from blogging are larger than the efforts. This paper examines a formal model of blogging. Data from an industry leading blog is analyzed with this model using web analytics measurements. The results give insights in how much to blog.

4 - Why Simpler Websites Perform Better - An Information Theory Based Empirical Evalidation

Zsolt Ugray, Assistant Professor, USU, 3515 Old Main Hill, Logan, UT, 84322-3515, United States of America, zsolt.ugray@usu.edu

Evidence is presented in support of the Information Theory based Minimum Cognitive Processing Theory as it applies to the online retail environment. The success of B2C commercial websites and the design complexity of their user interfaces are considered. Design features and characteristics of about a hundred online retail websites and corresponding online retail sales data are analyzed. The findings confirm that lower complexity websites tend to perform better.

■ WB18

C-Room 28C, Upper Level

Optimization in Practice VII - RAMP

Sponsor: Computing Society
Sponsored Session

Chair: José Ablanedo-Rosas, University of Texas at El Paso, 500 University Ave, El Pa, United States of America, jablanedorosas2@utep.edu

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - A Primal-dual RAMP Algorithm for Large-scale Set Covering Problems

José Ablanedo-Rosas, University of Texas at El Paso, 500 University Ave, El Pa, United States of America, jablanedorosas2@utep.edu, Cesar Rego

We present a Relaxation Adaptive Memory Programming (RAMP) algorithm for the solution of very large-scale Set Covering Problems (SCP). The algorithm implements a comprehensive Primal-Dual RAMP approach by effectively integrating surrogate dual information with primal information obtained by a simple scatter search component. The algorithm is very fast, finds the optimal or best known solutions for all classical benchmark problems and discloses new best solutions.

2 - An Enhanced Ejection Chain Algorithm for Hard Asymmetric Traveling Salesman Problems

Tabitha James, Associate Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24060, United States of America, tajames@vt.edu, Cesar Rego

Ejection chain methods that have been derived from the classical Lin-Kernighan procedure are currently some of the best performing methods for symmetric traveling salesman problems (STSP). Straightforwardly adapting this class of methods for asymmetric traveling salesman problems (ATSP) has proven to be challenging. We present an enhanced ejection chain algorithm for the solution of hard ATSPs, focusing on components of the algorithm that have proven to be beneficial in improving performance.

3 - New Advances on RAMP Algorithms for Facility Location

Dorabela Gamboa, Polytechnic of Porto, ESTGF-GECAD-CIICESI, Apt. 205, Felgueiras, 4610-156, Portugal, dgamboa@estgf.ipp.pt, Cesar Rego

The Uncapacitated Facility Location (UFL) problem is an important and challenging problem in combinatorial optimization with a broad range of applications. We present a simple RAMP algorithm that performs exceedingly well in all standard benchmark instances, including those known to be very difficult to solve.

■ WB19

C-Room 28D, Upper Level

Traffic Management I

Contributed Session

Chair: Daoqin Tong, Assistant Professor, Department of Geography and Regional Development, University of Arizona, Tucson, AZ, 85721, United States of America, daoqin@email.arizona.edu

1 - A New Methodology for Timing Transition in Time of Day Signal

Rita Penabaena, Universidad del Norte/University of South Florida, 4202 E. Fowler Ave, Tampa, Fl, 33620-5350, United States of America, rpenabae@mail.usf.edu

Suboptimal coordination parameters during the transition timing planning can increase delays and stops. It is important to develop a new methodology to improve the existing methods on coordinated signal timing transition. This methodology will be oriented to optimize traffic flow in transition periods by reducing disruption of optimal settings while minimizing the duration of the transition time

2 - A Stochastic Model of Traffic Flow and Its Application

Li Yang, University of Michigan-Ann Arbor, 3595 Green Brier Blvd Apt 106C, Ann Arbor, MI, 48105, United States of America, youngli@umich.edu

This research develops a robust stochastic model for the traffic flow and investigates dynamic congestion pricing based on the model. A stochastic model is constructed to describe both temporal and spatial evolution of traffic flow and validated by the real data. Then the system congestion in the near future could be predicted and evaluated based on the model. In the end, the tools of pricing financial derivatives is borrowed to price the congestion toll dynamically.

3 - Simulation-based Evaluation of ALINEA Ramp Control: A MD100 Case Study

Yuanyuan Hou, University of Maryland, 6100 Westchester Park Dr., Apt. 1716, College Park, 20740, United States of America, cnhyyde@umd.edu

This paper uses MD100, highway section from MD713 to US1 as a case location to evaluate the effectiveness of the ALINEA ramp control. The key parameters (target occupancy and mainline detector location) of ALINEA were identified and calibrated. The overall network performance was evaluated under "with" and "without" ramp metering conditions by CORSIM. The results confirm that ALINEA control improved mainline as well as ramp conditions at high demand.

4 - Robust Optimization for Traffic Signal Control Problems

Qing He, The University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, heqing@email.arizona.edu, Wei-hua Lin

A robust integer programming approach based on the cell transmission model is developed for the traffic signal control problem. The formulation takes into account uncertainties in vehicle arrivals and captures queue dynamics in traffic flow. Different types of robust control strategies are considered to generate a near-optimal signal timing plan. The near-optimal solution obtained with the robust optimization model is then compared with the solution obtained from an exact model.

5 - An Enhanced Geostatistical Model for Estimating Travel Time on an Urban Transportation Network

Daoqin Tong, Assistant Professor, Department of Geography and Regional Development, University of Arizona, Tucson, AZ, 85721, United States of America, daoqin@email.arizona.edu, Wei-hua Lin

An enhanced geostatistical model that generates spatial traffic intensity profiles for path travel time estimation on an urban transportation network is presented. In the model, we specifically take into account the directional property of traffic and other factors that may affect travel time, such as signal coordination, discontinuities in traffic states resulting from bottlenecks, etc.

■ WB20

C-Room 28E, Upper Level

Collaboration and Competition in Freight Transportation

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Shervin Ahmadbeygi, University of Michigan-Ann Arbor, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, shervin@umich.edu

1 - Collaboration for Truckload Carriers

Okan Ozener, Assistant Professor, Ozyegin University, Kusbaksi Cad. No:2 Altunizade/Uskudar, Istanbul, 34662, Turkey, orsan.ozener@ozyegin.edu.tr, Martin Savelsbergh, Ozlem Ergun

Because of historically high fuel prices, the trucking industry's operating expenses are higher than ever. To cut costs, the trucking industry is searching for and exploring new ideas. We investigate the potential of collaborative opportunities in TL transportation. The carriers may be able to reduce their repositioning costs by exchanging transportation requests. We develop various exchange mechanisms, which allow carriers to realize some or all of the costs savings opportunities.

2 - Dynamic LTL Freight Carrier Collaboration Network Design with Transfer and Holding Costs

Salvador Hernandez, PhD Candidate, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, shhernan@purdue.edu, Georgios Kalafatas, Srinivas Peeta

Smaller freight trucking companies have begun to collaborate to compete with larger firms for loads and to lower the impacts of fuel and energy prices. This study models the collaboration over a dynamic freight transportation network from the perspective a single carrier. The problem is formulated as a network design problem, and insights are presented on the effect of time-dependent transfer and holding costs on the design of the carrier-carrier collaborative network, and on fuel costs savings.

3 - Stochastic Combinatorial Truckload Procurement Auctions: A Computational Study

Shervin Ahmadbeygi, University of Michigan-Ann Arbor, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, shervin@umich.edu, Amitabh Sinha, Damian Beil, Amy Cohn, Richard Chen

We present a stochastic multi-commodity-flow formulation to solve the winner determination problem for combinatorial procurement auctions in which the carrier capacities are uncertain. In this problem, some of the flow decisions must be made in the absence of complete information while others can be deferred until the capacities are known. We formulate this problem and evaluate several different Benders decompositions of the model to compare their computational performance.

■ WB21

C-Room 30B, Upper Level

Automation and Material Handling

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu

1 - Optimization of Automated Float Glass Lines

Byungsoo Na, Graduate Student, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, United States of America, byungsoo.na@gatech.edu, Shabbir Ahmed, George Nemhauser, Joel Sokol

In automated float glass manufacturing, a continuous ribbon of glass is cut according to customer orders and then offloaded robotically. Minimizing wasted glass combines characteristics of cutting, packing, and sequencing problems. Our solutions achieve better than 99% yield, a significant improvement for the manufacturer where this work is being implemented.

2 - An Analytical Model for Conveyor-based Material Handling with Crossovers in Semiconductor Fabs

Dima Nazzal, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States of America, dnazzal@mail.ucf.edu, Jesus Jimenez, Vernet Lasrado, Hector Carlo, Andy Johnson

This research presents a queuing-based analytical model for designing closed-loop conveyor-based Automated Material Handling Systems (AMHS) for Semiconductor Wafer Fabs. Given a conveyor-based AMHS with turntables and crossovers, our model estimates the expected WIP on the conveyor, queuing delays due to congestion at intersection points, and assesses the conveyor system stability.

■ WB22

C-Room 30C, Upper Level

Models for Fractional Airlines

Contributed Session

Chair: Haiyuan Wang, Operations Research Analyst, CitationAir, 5 American Lane, Greenwich, CT, 06831, United States of America, hwang@citationshares.com

1 - On-Demand Airline Scheduling Optimization: Development and Deployment

Lezhou (Roger) Zhan, Director, Operations Research, CitationAir, 5 American Lane, Greenwich, CT, 06831, United States of America, lzhan@citationshares.com, William Hall, Haiyuan Wang, Jintao Ouyang, Aang Daniel

Due to the nature of on-demand airlines, the scheduling problem has to be solved many times a day in order for jet and crew movements to be optimized in real time. Collaborating with Georgia Tech, we formulated and solved an integer programming problem within a minute to find the minimum-cost set of aircraft and crew assignments that satisfies a wide variety of constraints. The system was successfully deployed with the help of an innovative user interface and automated performance metrics.

2 - An Integer Program for Balancing Crew Training and Vacation in Fractional Airlines

Haiyuan Wang, OR Analyst, CitationShares, 5 American Lane, Greenwich, CT, 06831, United States of America, hwang@citaionshares.com, Lezhou (Roger) Zhan, William Hall, Aang Daniel, Jintao Ouyang

In this paper, an integer program is formulated for allocating crew training and vacation slots to provide consistent crew availability throughout the year. The objective function currently used is to minimize the maximum of uncrewed airplanes on each day in a fractional airline company. Results show smaller variability of crew availability is achieved through planning.

3 - Optimization Based Simulation in Fractional Aircraft Management

Jintao Ouyang, Operations Research Analyst, CitationAir, 5 American Lane, Greenwich, CT, 06831, United States of America, jouyang@citationshares.com, Haiyuan Wang, William Hall, Lezhou (Roger) Zhan, Aang Daniel

We proposed a simulation framework for fractional jets operation. It employs a column generation based scheduling optimization model, flight demand and maintenance pattern as well as scheduler's behavior. The objective is to facilitate the decision of the various operational strategies by using this tool.

■ WB23

C-Room 30D, Upper Level

Modeling, Operations Research, and Decision Making II

Sponsor: Military Applications Society
Sponsored Session

Chair: William Fox, Professor, Naval Postgraduate School, 589 Dyer Rd, Room 103F, Monterey, CA, United States of America, wpfox@nps.edu

1 - Sensing and Identification of People and/or Animals Carrying Wires on Their Bodies

William Fox, Professor, Naval Postgraduate School, 589 Dyer Rd, Room 103F, Monterey, CA, United States of America, wpfox@nps.edu, John Vesecky, Ken Laws

We develop a set of several target models, based on likely wire configuration to be used by suicide bombers, e.g. wire location, size number, etc. We develop an analytical model for people tracking performance of a video surveillance system based on the selected observational geometries and existing people tracking experience in the computer vision and related literature. We build a simulation model and evaluation of performance for several video-radar system configurations.

2 - The Trouble with Multi-Criteria Decision Analysis (MCDA) for Military Applications

Edouard Kujawski, Systems Engineering Department, Naval Postgraduate School, Monterey, CA, 93943

The US Department of Defense and the services make extensive use of Multi-Attribute Utility Theory (MAUT) and the Analytic Hierarchy Process (AHP) to aid and support important decisions. MAUT builds on the utility theory axiomatically formalized by von Neumann and Morgenstern. AHP was developed by Saaty as a method to relative measure of both tangible and intangible criteria. Implicit in both models are assumptions that are not universally applicable. These include the following assumptions: (1) The existence of a world in which the 'Rational Individual' can completely determine the utility or priority of each alternative; (2) End-effects or measures of effectiveness are linearly related to the selected criteria or measures of performance; and (3) The 'Rational Individual' should be indifferent between receiving some amount of money $Y < $X and the lottery [p*$X, (1-p)*Death] for some probability p. The second and third assumptions are especially suspect for the selection and acquisition of military systems of systems. Unfortunately, MCDA models are widely overused and over-zealous proponents apply them indiscriminately to situations where they may lead to poor decisions. Pointing out common mistakes and pitfalls is of limited value. It is time to rethink the applicability of MCDA for military applications.

3 - Analyzing the Western Border Security in Al Anbar, Iraq

Anastasios Tom Tsoutis, Marine Corps Operations Analysis Division, anastasios.tsoutis@usmc.mil

In this research, we analyze the effectiveness of the western border security. The assessment aims to answer if the Multi National Force-West objectives are being met, and where to best invest resources. Understanding of the dynamics of the western border security and its influence on the Al Anbar Province requires knowledge of insurgent activity, local culture, and local atmospherics. Border security cannot be looked solely from a conventional military perspective. The border comprises human terrain which does not live in isolation of the rest of Al Anbar. One unique challenge is how to interdict the flow of security-related threats without adversely impacting the non-threatening smuggling that has benefited the local tribes for centuries. In addition, to addressing the situation along the border, one must account for insurgent activity in the main population centers. The presentation will cover a value-focused thinking approach implemented to piece various disbursed information into a meaningful picture and to assess the border security in the Al Anbar Province of Iraq.

■ WB24

C-Room 30E, Upper Level

Missile Defense

Contributed Session

Chair: George Mayernik, Raytheon Integrated Defense Systems, 235 Presidential Way, MS 26/3529, Woburn, MA, 01801-1060, United States of America, George_E_Mayernik@raytheon.com

1 - Missile Defence Location Optimisation

Axel Bloemen, Scientist, TNO, Oude Waalsdorperweg 63, Den Haag, Netherlands, axel.bloemen@tno.nl

To defend an area against the impact of ballistic missiles (BMs), missile defence interceptor systems have to be positioned at suitable locations. The missile defence location optimisation problem is to minimise the number of interceptor systems that is needed, and to determine their best possible locations. In this presentation, the missile defence location optimisation problem is explained and solution methods are discussed.

2 - Operations Analysis of Multi-layer Ballistic Missile Defense

Billy Bradley, Senior Systems Engineer, Raytheon Integrated Defense Systems, 235 Presidential Way, Woburn, MA, 01801, United States of America, billy_w_bradley@raytheon.com

This presentation involves one of showing how multiple layers of defense change the Ballistic Missile Defense Equation. Analysis will include what layers are most effective and least effective, how to handle multiple targets and how randomization of hits to enemy incoming warheads will change the defense as the battle progresses. The layers of defense will be analyzed to see where what could be done to make the layer more effective. Presentation is unclassified.

3 - Characterization of Ballistic Missile Defense in a Raid Environment

George Mayernik, Raytheon Integrated Defense Systems, 235 Presidential Way, MS 26/3529, Woburn, MA, 01801-1060, United States of America, George_E_Mayernik@raytheon.com, John Krasnakevich, Michael McGowan

Recent MDA 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 ballistic missile defense against a raid of threats and subsequent impact on radar duty. The effect of raid size and density is shown including defense systems effectiveness in mitigating stressing raid conditions. Engagement timeline, defended area and leakage rate trends for scenarios are presented.

4 - Robustness of Networks with Non-cooperating or Opposing Nodes

Herman Monsuur, Associate Professor, Netherlands Defence Academy, Faculty of Military Sciences, P.O. Box 10.000, Den Helder, 1780 CA, Netherlands, H.Monsuur@nlda.nl, Rena Janssen

We investigate the relationships between architecture and functioning of a network in Network Centric Operations. In particular, we investigate how non-cooperating or opposing (sometimes hidden) nodes affect robust information propagation through a network. How to design networks that minimize non-local and non-linear effects of propagation of false information through a dynamic network? The answer to these questions contributes to desired mission control and situation awareness.

■ WB25

C-Room 31A, Upper Level

Air Traffic Management I

Sponsor: Aviation Applications

Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, Department of Civil Engrg., 1173 Martin Hall, College Park, MD, 20742, United States of America, lovell@umd.edu

1 - FAA Economic Factors Used in Analyses

Gabriela Rohlck, Operations Research Analyst, MCR/FAA, 600 Maryland Ave, SW, Suite 700E, Washington, DC, 20024, United States of America, grohlck@mcri.com

This paper provides the methodology used to develop the economic factors that support Investment Analyses throughout the FAA. These factors were developed for use in cost-benefit analyses performed in 2009 and are modified and updated as necessary. The factors include high-level data needed to perform business case analyses as a single integrated source, e.g., inflation, discount rates, aircraft utilization, aircraft operating costs incorporating changing fuel costs among others

2 - Airline ADS-B Equipage Business Case Analysis Tool

Gary Paull, Sr Operations Research Analyst, MCR, 600 Maryland Ave, SW, Suite 820E, Washington, DC, 20024, United States of America, gpaull@mcri.com, Dan Howell, Jen King

FAA made a final investment decision to implement Automatic Dependent Surveillance-Broadcast (ADS-B) as the primary surveillance source for air traffic management. Aircraft equipage is a critical aspect. The Aviation Rulemaking Committee suggested a tool to assist operators in this decision from an economic perspective. This paper describes the Business Case Analysis Tool developed by the FAA SBS and presents an example, and discusses lessons learned

3 - Minimum Cost Fleet Mix under Greenhouse Gas Regulation

Megan Smirti, PhD Candidate, University of California, Berkeley, 109 McLaughlin Hall, Institute of Transportation Studies, Berkeley, CA, 94720-1720, United States of America, msmirti@berkeley.edu, Mark Hansen

This research presents a methodology to compare the costs of turboprop and jet aircraft and select the minimum cost fleet mix to serve a corridor under Greenhouse Gas (GHG) regulation. Three categories of cost models are developed: a detailed aircraft operating cost model; a passenger preference cost model; and a GHG cost model. Using these models, the impact of GHG regulation on fleet mix changes, fuel consumption, passenger service, and ultimately GHG emission is evaluated.

4 - Airline Cancellation and Substitution Behavior under Air Traffic Management Initiatives

Mark Hansen, Professor, University of California, Berkeley, Berkeley, CA, United States of America, hansen@ce.berkeley.edu, Jing Xiong

FAA uses Traffic Management Initiatives (TMI's) to mitigate the consequences of aviation system capacity shortfalls. TMI's are implemented in a manner that affords airlines opportunities to make choices such as canceling flights and re-assigning slots. However, there has been little study of airlines' resulting behavior. In this study, we will analyze choices made by airlines in response to TMI's and attempt to infer from these key features of airlines' preference structures.

■ WB26

C-Room 31B, Upper Level

Data Envelopment Analysis I

Contributed Session

Chair: Emilyn Cabanda, Dr/Prof, Regent University, 1333 Regent University Drive, Suite 102, Virginia Beach, VA, 23464, United States of America, ecabanda@regent.edu

1 - A Comparative Study on the Performance and the Selection of Hedge Funds

Komlan Sedzro, University of Quebec at Montreal, 315 Sainte Catherine Est, Montreal, QC, H3C3P8, Canada, sedzro.k@uqam.ca, Michel Bergeron

We employ several measures to rank the performance of hedge funds. We consider measurements proposed in the financial literature, such as Sharpe, Sortino and Omega ratios, as well as some less common measures like the stochastic dominance approach, the classical DEA method, and the stochastic dominance DEA of Kuosumanen. Our results show that these measures lead to different rankings of hedge funds, but the stochastic dominance DEA gives better results for the selection of hedge funds.

2 - Evaluating Port Operating Efficiency in China with Data Envelopment Analysis

Hongman Gao, Assistant Professor, Jackson State University, 1400 Lynch St, Jackson, MS, 39217, United States of America, hongman.gao@jsums.edu, José Ablanedo-Rosas, Bahram Alidaee, Haibo Wang

This research examines the efficiency of 16 major Chinese seaports by using DEA. DEA is a nonparametric approach to weight the inputs/outputs and measure the relative efficiency of DMUs. The results of DEA show that 25% of 16 Chinese ports were efficiently operated. In order to confirm the findings, a forecasting model is provided to analyze the future performance of the Chinese seaports. Finally, suggestions based on the data analysis are provided for managerial.

3 - A Frontier Analysis of Indonesia's Stock-listed Manufacturing Companies

Emilyn Cabanda, Dr/Prof, Regent University, 1333 Regent University Drive, Suite 102, Virginia Beach, VA, 23464, United States of America, ecabanda@regent.edu, T.Handono Eko Prabowo

This research examines the efficiency performance of manufacturing sector listed on Indonesia Stock Exchange (IDX), comprising of 121 panel firms over six years. We use stochastic frontier analysis (SFA), first-stage data envelopment analysis (DEA) and the two-stage DEA. The combined approaches lead to robust and bias-free analysis of the manufacturing sector performance. Our results show that the two-stage DEA and SFA are much better in modeling performance of the manufacturing sector.

■ WB27

C-Room 31C, Upper Level

Simulation Optimization II

Sponsor: INFORMS Simulation

Sponsored Session

Chair: Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, enluzhou@umd.edu

1 - Fluid Model of the Resilient Packet Ring

Jian-Qiang Hu, Professor, Fudan University, Siyuan Building, Rm 508, 670 Guoshun Rd, Shanghai, 200433, China, hujq@fudan.edu.cn, Min Chen

In this paper, we develop a fluid model for the study of Resilient Packet Ring (RPR). The key characteristic of our proposed fluid model is that it has multiple classes of flows that are processed based on dynamic priority service disciplines. We derive the differential dynamic equations for the fluid model and demonstrate how the technique of perturbation analysis can be used in such a fluid model to perform sensitivity analysis with respect to key parameters of interest.

2 - Optimal Level Splitting for Rare-Event Simulation

John Shortle, George Mason University, 4400 University Dr., MSN 4A6, Fairfax, United States of America, jshortle@gmu.edu, C. H. Chen

In this talk, we address the problem of choosing the best among several alternatives, where the evaluation of each alternative requires estimating the probability of some rare event. Level splitting is a technique that has been used to improve the efficiency of rare-event simulation. We propose a method to allocate the computing budget among levels and alternatives to optimize the efficiency of the simulation.

3 - Optimal Computing Budget Allocation for Constraints and Multiobjective Problems

Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, iseleelh@nus.edu.sg

In this talk, we will present some of the latest work that we have developed for constraint problems and multi-objective probelms.

4 - A Numerical Method for Financial Decision Problems under Stochastic Volatility

Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, enluzhou@umd.edu, Michael Fu, Kun Lin, Steven Marcus

We propose an efficient numerical method for financial decision problems under stochastic volatility, based on a method developed recently for solving continuous-state partially observable Markov decision processes. Numerical applications are presented and discussed for a problem of hedging European put and call options.

■ WB28

H-Room 500, Fifth Floor

Distribution Channels

Sponsor: Revenue Management and Pricing

Sponsored Session

Chair: Mark Bergen, Carolyn I. Anderson Professor of Business Education Excellence, University of Minnesota, Carlson School of Management, 321, 19th Ave.S., Minneapolis, MN, 55455, United States of America, mbergen@csom.umn.edu

1 - Joint Inventory and Pricing for a Dual Channel Retailer

Hassini Elkafi, McMaster University, DeGroote School of Business, Hamilton, ON, Canada, hassini@mcmaster.ca, Mohamed Mahaboob

We consider a problem faced by a retailer with store and web channels. The web channel is used as to sell overstock at a discount. We develop a single period two-stage stochastic program to determine the stocking quantity along with the prices charged in the two channels.

■ WB29

H-Room 501, Fifth Floor

Green Energy III

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

Co-Chair: Niko Iliadis, EnerCoRD, Plastira Street 4, Nea Smyrni, Athens, 171 21, Greece, niko.iliadis@enercord.com

Co-Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - Including Wind in Power-System Siting and Capacity Expansion Models

Richard Chen, University of Michigan, IOE, Ann Arbor, United States of America, richchen@umich.edu, Duncan Callaway, Amy Cohn

When including wind in power-system design models, it is important to take into account transmission losses, because wind is often cited far from the load centers, unlike conventional power sources such as coal or natural gas based generation. We present new models for siting and capacity expansion planning that incorporate wind and the associated transmission losses. We demonstrate how these models can be solved using a variation of Benders Decomposition.

2 - Test-and-Prune: Designing Wind Farms with Probabilistic Constraints

Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu, Richard Chen, Duncan Callaway

We present models for designing networks of wind farms in which probabilistic constraints on loss-of-load must be enforced. We demonstrate the challenges of solving these models with traditional IP techniques and introduce a new algorithm, which we call Test-and-Prune, to overcome these challenges.

3 - Incorporating Renewables and Demand Response into Unit Committment Problems

Jayant Kalagnanam, Senior Manager, IBM T.J. Watson Research Center, Yorktown Hts, NY, 10598, United States of America, jayant@us.ibm.com

Many utilities have begin to incorporate wind and solar energy as part of their generation portfolio. Due to uncertainty from weather this leads to uncertainty in generation sources which needs to be explitly modeled in the unit committment problem. We study the stochastic unit committment problem to solve for generation uncertainty.

4 - Optimization of Wind Farm Portfolios

Warren Powell, Professor, Princeton University, Sherrerd Hall 230, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Yintao (Alex) Sun

The electricity from multiple wind farms can be combined on a single electric power grid, making it possible to balance correlations in output to produce a portfolio with lower overall volatility. We use both a Markowitz model and a stochastic gradient algorithm to design wind portfolios which mitigate the intermittent nature of wind by using actual wind profiles which reflect spatial and temporal correlations. Numerical experiments demonstrate the effectiveness of the strategy.

■ WB30

H-Room 502, Fifth Floor

Energy III

Contributed Session

Chair: Bernard Lamond, Professor, Laval University, Dep OSD Pav Palasis-Prince, 2325 rue de la Terrasse, Quebec, QC, G1V 0A6, Canada, bernard.lamond@fsa.ulaval.ca

1 - A Novel Stochastic Programming Algorithm for Minimization of Fresh Water Consumption in Power Plants

Urmila Diwekar, President, Vishwamitra Research Institute, 368 56-th Street, Clarendon Hills, IL, 60514, United States of America, urmila@vri-custom.org, Juan Salazar

Coal-fired power plants are widely recognized as major water consumers whose operability has started to be affected by drought conditions across some regions of the country. Optimization under uncertainty for these large-scale complex processes is carried out using a novel better optimization of nonlinear uncertain systems (BONUS) algorithm . This new algorithm saved the water consumption by 12% with 99.7% savings in computational efficiency.

2 - Economic Analysis of Industrial Clusters—Optimal Design and Operation

Kjetil Midthun, Research Scientist, SINTEF, SP Andersens vei 5, Trondheim, 7465, Norway, Kjetil.Midthun@sintef.no

We present a linear optimization model for economic analysis and assessment of an industrial cluster with respect to design and operation. The model includes a simplified representation of the technical aspects; as a range of technical details will be important regarding the joint operation and the economical profitability. The model is developed within a project which aims to assess the potential for environmentally justifiable utilization and industrial processing of natural gas.

3 - Reducing Uncertainty in Energy Efficiency Investments

Ines Lima Azevedo, Research Engineer, Carnegie Mellon University, Dep. of Engineering & Public Policy, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, iazevedo@cmu.edu

Energy efficiency has been claimed to be a low hanging fruit in energy and climate policy. However, there is a uncertainty on how much economic and environmental savings can energy efficiency deliver. I present a tool that quantitatively explores the uncertainty in economic, environmental and energy indicators for efficiency investments in the U.S. residential sector, under plausible market and policy conditions, with key recommendations for policy in energy and climate change.

4 - On Computing Partial Expectations for Two Reservoirs With Concave Energy Rewards

Bernard Lamond, Professor, Laval University, Dep OSD Pav Palasis-Prince, 2325 rue de la Terrasse, Quebec, QC, G1V 0A6, Canada, bernard.lamond@fsa.ulaval.ca

We consider a stochastic dynamic optimization model of two reservoirs in series. We assume piecewise linear concave revenues for electricity produced but, unlike most authors, who do not assume perfectly correlated natural inflows. We examine the impact of the concavity assumption in the optimization and expectation steps of dynamic programming and, in particular, the computation of probabilities and partial expectations, using some special structure of the model.

■ WB31

H-Room 503, Fifth Floor

Estimation of Revenue Management Impact in Airlines and Internet

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Goutam Dutta, Professor, Indian Institute of Management, Wing 3,P&QM Area, IIM, Ahmedabad, Ahmedabad, 380015, India, goutam@iimahd.ernet.in

1 - Impact of Demand Unconstraining and Accounting for Dependency on Airlines Revenue Performance

Sandeep Karmarkar, Doctoral Student, Indian Institute of Management, Ahmedabad, Room No 24, Dorm No 23, IIM Campus, Ahmedabad, 380015, India, sandeepak@iimahd.ernet.in, Goutam Dutta, Tathagata Bandyopadhyay

Accurate forecasts are crucial to revenue management. Historical demands can sometimes be censored. In this paper, we try to unconstrain the correlated censored demands using EM algorithm. These forecasts are used to find booking limits under uncorrelated and correlated demands for two fare classes. A comparison across four cases: unconstrained Vs constrained, and dependent Vs independent demands shows that revenue up to 2% can be increase.

2 - Online Advertising Revenue Management

Goutam Dutta, Professor, Indian Institute of Management, Wing 3,P&QM Area, IIM, Ahmedabad, Ahmedabad, 380015, India, goutam@iimahd.ernet.in, Sandeep Karmarkar

In this paper, we extend the concept of revenue management to online advertising. We develop a multi-period space-allocation model for banner-ads to make a trade-off between cost-per-view and cost-per-click pricing schemes taking into account various features of internet like non-uniform demands and unpredictable web-traffic. An RM approach yields about 20% more revenue when compared to fixed capacity bucket policy under which fixed ad-space is allocated to either of the advertising categories.

■ WB32

H-Room 504, Fifth Level

Finance and Risk Management I

Contributed Session

Chair: Andrew Sanford, Lecturer - Finance, Monash University, Department of Accounting and Finance, Monash University, Clayton VIC, 3800, Australia, Andrew.Sanford@Buseco.monash.edu.au

1 - Conditional and Distressed Value-at-Risk: A Modeling Approach

Jared Klyman, Graduate Student, Princeton University, 8 Lawrence Drive, Apt. 308, Princeton, NJ, 08540, United States of America, jklyman@princeton.edu, Patrick Cheridito

In this paper we explore the notion of Conditional-Value-at-Risk (CoVaR) as introduced in Brunnermeier, Adrian. In particular, we define it on L^0, and exhibit the basic properties. Furthermore, we introduce Distressed-Value-at-Risk (DistVaR), a more intuitive measure. The goal is to quantify counterparty risk, and to identify those "keystone" firms most likely to cause market downturns. Finally, we proceed to perform calculations for these risk measures for various market models.

2 - Principal-agent Relationship Among Venture Capitalist, Bank and Enterpriser

Yan WenJun, The School of Management Xi'an Jiao Tong University, Xi'an Jiao Tong University, Xi'an, China, ywj0125@gmail.com, Guo Ju E

A principal-agent model had been set up ,to studied participation constraint, effect factor of effort level among bank, venture capitalist and enterpriser ,and double moral hazard between venture capitalist and enterpriser. The conclusions had been proved, there was a risk restrict where only bank or bank and venture capitalist invested, equity arrangement concerned with throughput.

3 - Bayesian Networks, Operational Risk and Organizational Learning in Structured Finance Operations

Andrew Sanford, Lecturer - Finance, Monash University, Department of Accounting and Finance, Monash University, Clayton VIC, 3800, Australia, Andrew.Sanford@Buseco.monash.edu.au, Imad Moosa

A Bayesian network is developed to model the operational risks associated with the structured finance unit of a major Australian bank. Existing human error and subjective workload frameworks are incorporated to support decision making. The network also allows for the learning of probabilities as new operational risk events arise.

■ WB33

H-Room 505, Fifth Floor

Operations/Finance Interface

Contributed Session

Chair: Beate Klingenberg, Assistant Professor of Management, Marist College, 3399 North Road, Poughkeepsie, NY, 12601, United States of America, Beate.Klingenberg@marist.edu

1 - Financial Instruments for Strategic Consumer

Mike Mingcheng Wei, Washington University at St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130, United States of America, weim@wustl.edu, Tao Yao

Holiday merchandises, such as Halloween costumes, are often offered at high price before holiday, but will be markdown heavily after that. By observing this pricing pattern, strategic customers will behave accordingly. Moreover, the holiday sell often lead to over crowd shopping environment, which bring additional cost for both retailer and customer. In this research, we introduce financial instruments to resolve this congestion problem from both retailer and supply chain's perspective.

2 - On the Optimal Working Capital Allocation in a Multi-echelon Supply Chain

Margarita Protopappa, Assistant Professor, European Business School, Soehnleinstrasse 8F, Wiesbaden, 65201, Germany, margarita.protopappa@ebs.edu, Ralf Seifert

Financial supply chain management can boost performance and profitability. In our paper we elaborate on working capital allocation and inventory decisions in a supply chain. We investigate the relation between payment delays and profitability. Our results demonstrate significant cost savings under a joint working capital allocation. We show that extending payment delays to the suppliers increases costs for the supply chain.

3 - The Stochastic Lot Sizing Problem From a Financial Perspective

Nico Vandaele, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, nico.vandaele@kuleuven-kortrijk.be, Lien Perdu

Operational models are typically used to minimize lead times. Unfortunately, they do not take into account the financial aspects of the decision. Financial models on the other hand try to optimize costs or profits but lack an integration with the operational performance measures. Therefore, an integrated operational-financial model is constructed for the stochastic lot sizing problem through a study of several operational factors that have an impact on the financial bottom line.

4 - Market Power vs. Economies of Scale: An Analysis of Economic Efficiency

Pedro Ferreira, Carnegie Mellon University, 5000 Forbes Avenue HBH 2102D, Pittsburgh, United States of America, pedrof@cmu.edu, John Chuang

Oligopoly outcomes differ from perfect competition when firms exhibit Economies of Scale (EoS). Fewer firms reduce costs but exert more market power. We study how EoS and market power trade-off. We show how economic efficiency depends on the relative slopes of the marginal cost curve and of the demand curve. We provide an economic interpretation of this ratio.

5 - A Critical Perspective on Measuring the Impact of JIT on Financial Performance

Beate Klingenberg, Assistant Professor of Management, Marist College, 3399 North Road, Poughkeepsie, NY, 12601, United States of America, Beate.Klingenberg@marist.edu, Tom Geerd Geurts

Operations management designs and controls processes to optimize productivity, using tactics such as Just in Time Manufacturing. The question remains how to measure the exact impact on financial performance. Previous work studied the effect on profitability ratios. This paper posits that such ratios are inadequate to specifically identify the impact of operations. The suitability of other financial ratios is tested and critically discussed.

■ WB34

H-Room 520, Fifth Floor

Joint Session OR.MS/TSL: Evacuation

Cluster: OR/MS with Societal/ Humanitarian Impact & Transportation Science and Logistics

Invited Session

Chair: Mark Hickman, Associate Professor, ATLAS Center, University of Arizona, P.O. Box 210020, Tucson, AZ, 85721-0020, United States of America, mhickman@engr.arizona.edu

1 - Dynamic Evacuation Planning under Hazardous Material Releases

Chi Xie, Research Fellow, The University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78759, United States of America, chi.xie@mail.utexas.edu, Mohamed Tasb, Travis Waller

We present a modeling framework and solution procedure that integrates latest atmospheric dispersion and network flow modeling techniques for more secure and efficient evacuation planning solutions under hazmat releases. Incorporating time-dependent transport and dispersion of hazardous effluents into a planning process enables us to quantify the distribution and growth of hazardous plume concentration and hence guide evacuation flows in a manner of minimizing the population's risk exposure.

2 - Demand-Based Strategies in Evacuation Planning

Douglas Bish, Assistant Professor, Virginia Tech, 250 Durham Hall, Virginia Tech, Blacksburg, VA, 24061, United States of America, drb1@vt.edu, Hanif D. Sherali

Evacuation is an essential life-saving response to disasters such as hurricanes. Large evacuations that rely on automobiles are often plagued by traffic congestion, which leads to longer and costlier evacuations, lower evacuation rates, and increased risk to the population. Supply-based strategies have traditionally been used, but they are often insufficient. This research explores the use of demand-based strategies to manage the evacuation demand and thus eliminate or reduce congestion.

3 - Evacuation Transportation Planning: An Affine Adjustable Robust Optimization Approach

Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Byung Do Chung, Supreet Reddy Mandala, Aharon Ben-Tal

This paper considers operation and planning of evacuation transportation networks in an uncertain environment. We develop an affine adjustable robust linear programming model to study the multi-period planning and operating problem. Simulation experiments show that the affine adjustable robust counterpart (AARC) solution provides excellent results comparing to robust counterpart (RC) solution or sampling based stochastic programming solution.

4 - Arc Routing for Evacuation

Mark Hickman, University of Arizona, Tucson, AZ, mhickman@email.arizona.edu, Moshe Dror

We consider how to set up a routing of public vehicles to evacuate persons during a short-notice emergency; e.g., in flooding, fire, etc. To facilitate evacuation, we consider picking up people where they are currently located. In these events, one might route vehicles along roadways, in the form of an arc routing problem, to pick them up. We present the basic arc routing model for this case and illustrate this on a realistic case study.

■ WB35

H-Sapphire A, Fourth Floor

Dynamic Programming and Optimal Control Applications in Medical Decision Making

Sponsor: Health Applications

Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu

Co-Chair: Jagpreet Chhatwal, Merck Research Labs, North Wales, PA, 19454, United States of America, Jchhatwal@gmail.com

1 - Optimal Stopping Model for Hemodialysis Treatment Planning

Santanu Chakraborty, Purdue University, Champaign, IL, 61822, chakrabs@purdue.edu, Mark Lawley, Kumar Muthuraman

One major problem in hemodialysis patients is stenosis in the dialysis access. Average life of an access is 2 years. Also there are only 4 places where an access can be created. Thus timely intervention has significant impact on a patient's life. The objective of this work is to develop an optimal policy for time of intervention to maximize the life of the access. In this work we use a stochastic optimal stopping model based on Gompertz diffusion process to compute the optimal treatment time.

2 - Optimal Management of Mammography Findings for Breast Cancer Diagnosis Considering Non-adherence

Jagpreet Chhatwal, Merck Research Labs, North Wales, PA, 19454, United States of America, Jchhatwal@gmail.com, Oguzhan Alagoz, Elizabeth Burnside

We developed a finite-horizon MDP model to find the optimal policies for biopsy or follow-up exam that maximizes a patient's total expected quality-adjusted life years while accounting for the possibility of non-adherence of the patient to the recommended policies. We use clinical data to conduct numerical analyses, which show that the number of unnecessary breast biopsies can be reduced if patients adhere to the recommended decisions.

■ WB36

H-Sapphire B, Fourth Floor

Modeling for Public Health Emergency Preparedness

Sponsor: Health Applications
Sponsored Session

Chair: Julie Ivy, Assistant Professor, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, jsivy@ncsu.edu

1 - A Stochastic Programming Model for Optimal Scheduling of Prophylactic Dispensing Centers

Lindsay Moomaw, Student, North Carolina State University, 307 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27695, United States of America, lmmoomaw@ncsu.edu, Brian Denton

With increased threats of bioterrorist attacks and the spread of influenza pandemics, public health officials must be prepared to respond quickly and efficiently with treatment and prophylaxis. In this talk we discuss optimal patient scheduling in the presence of uncertainty using a two-stage stochastic linear programming model. We discuss the structure of the model, methods for solving it, and numerical results that provide insights into optimal scheduling policies.

2 - Stochastic Alert Threshold Model Development for North Carolina Health Alert Network

Emine Yaylali, Graduate Student, North Carolina State University, Graduate Program in Operations Research, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, eyaylal@ncsu.edu, Julie Ivy

North Carolina Health Alert Network (NC HAN) is an alert system which provides critical health information in response to public health threats, e.g., communicable disease, bioterrorism or other types of threats. We model North Carolina public "health" with respect to the level of potential threat as a tiered finite, discrete-time POMDP. We seek an optimal alert threshold policy in order to minimize total expected system operating cost while avoiding false alerts and late alerts.

3 - Public Health Emergency Disease Spread and Facility Location Model

Sean Carr, Ph.D. Student, North Carolina State University, 7131 Almaden Way, Cary, NC, United States of America, smcarr2@ncsu.edu, Reha Uzsoy, Stephen Roberts

The proposed models can be used by public health and healthcare personnel to improve planning and response strategy for large-scale public health emergencies. A SIR Disease Spread is used to generate demand for a facility location model with queuing at facilities. Model decisions include locating health facilities and allocating healthcare resources such that the overall cost of patient travel and resource positioning is minimized subject to congestion constraints.

4 - Engineering the Response to a Pandemic

Richard Larson, Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-233, Cambridge, MA, 02139, United States of America, rclarson@MIT.EDU, Karima Nigmatulina

A standard engineering approach to a pandemic is to look at sub-problems: supply chain logistics of anti-virals and vaccines; hospital surge capacity; etc. But history has shown that human behavior should be part of any comprehensive analysis. Communicating with the public about social distancing, self-isolation and hygiene can result in behavioral changes that reduce outbreak severity. Mathematical models depicting these effects can be drawn into a more comprehensive engineering approach.

■ WB37

H-Sapphire C, Fourth Floor

Practice and Empirics

Contributed Session

Chair: Daniel Rexhausen, Supply Chain Management Institute (SMI), European Business School (EBS), Soehnleinstrasse 8, Wiesbaden, 65201, Germany, daniel.rexhausen@ebs.edu

1 - Knowledge Transfer Between Manufacturers and Their Suppliers

Bin Xie, Associate Professor, Tsinghua University, School of Economics and Management, Beijing, 100084, China, xieb@sem.tsinghua.edu.cn, Zhenlong Tan, Rui Ding

Companies and their suppliers can potentially enhance their productivity through diffusion of knowledge, however such a potential for knowledge creation and transfer in the supply chain has not been fully explored. Based on interviews with managers of 15 manufacturing companies in China in 2007 and 2008, a framework for knowledge transfer between manufacturers and their suppliers was established from three perspectives with 10 elements.

2 - Customer Facing SCM Practices - The Impact of Demand and Distribution Practices on Supply Chain Success

Daniel Rexhausen, Supply Chain Management Institute (SMI), European Business School (EBS), Soehnleinstrasse 8, Wiesbaden, 65201, Germany, daniel.rexhausen@ebs.edu, Richard Pibernik, Gernot Kaiser

Effective management of the customer interface is a key to sustainable supply chain success. The purpose of this study is to investigate the impact of customer-facing SCM practices on supply chain performance. Data from 116 multi-national companies were collected and analyzed. The results show that effective demand and distribution management have significant positive influence on supply chain performance. Moreover, the determinants of effective demand and distribution management are presented.

■ WB38

H-Sapphire D, Fourth Floor

Recent topics in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Rommert Dekker, Erasmus School of Economics, Erasmus University Rottterdam, BurgOudlaan 50, Rotterdam, Netherlands, rdekker@ese.eur.nl

1 - Optimal Policies in the (S-1; S) Lost Sales Inventory Model with Multiple Demand Classes

Willem van Jaarsveld, Erasmus School of Economics, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, vanjaarsveld@ese.eur.nl

This paper examines the heuristics proposed by Kranenburg and van Houtum (2007) for finding good rationing policies in the (S-1,S) lost sales inventory model with multiple demand classes. Our main result is that we establish guaranteed optimality for two of these heuristics. As a corollary, we provide an alternative proof for the optimality of rationing policies.

2 - Flexibility in Port Selection: a Quantitative Approach Using Floating Stocks

Eelco van Asperen, Erasmus School of Economics, P.O. Box 1738, Rotterdam, Netherlands, vanasperen@ese.eur.nl

Ports provide a number of logistical choices concerning storage, onward transport, and postponement. We investigate the flexibility offered by ports with a central location with respect to the hinterland. This flexibility consists of a pooling of safety stocks by rerouting containers. We analyse both inventory and transportation costs.

3 - Final Buy Inventory Problem with Remanufacturing Control Policies

Morteza Pourakbar, Erasmus School of Economics, Erasmus University Rotterdam, BurgOudlaan 50, Rotterdam, 3000DR, Netherlands, pourakbar@ese.eur.nl

We investigate the impact of re-manufacturing control policies on end-of-life inventory decisions in the presence of phase-out returns. We analyze the problem under PUSH and PULL re-manufacturing policies.

■ WB39

H-Sapphire E, Fourth Floor

Performance Management in Stochastic Inventory Settings

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu

1 - Accounting for Multivariate Parameter Uncertainty in Multi-product Inventory

Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu, Canan Gunes

Motivated by the need to build multivariate demand models for multi-product inventory simulations, we build a Bayesian model to account for both multivariate demand uncertainty and stochastic uncertainty in the output analysis of multi-product inventory simulations. We show that the resulting model provides accurate estimates for mean line-item fill rates and high coverage for their confidence intervals.

2 - Managing Decentralized Distribution: Insight and Incentives for Collaboration

Moshe Dror, Eller College of Management, The University of Arizona, McClelland Hall 430, 1130 East Helen Street, Tucson, AZ, 85721, United States of America, mdror@eller.arizona.edu, Nichalin Suakkaphong

We study a decentralized distribution system with a profit sharing arrangement among independent retailers who collaborate with respect to demand realizations. The profit sharing rules and procurement strategies like the ones found in the literature will result in a stable optimal (first-best) outcome only if (i) demand parameters satisfy a number of restrictive conditions, (ii) complete information assumption holds, and (iii) all the parties select Nash equilibrium strategy.

3 - Flexible Service Contracts and Spare Part Criticality in Spare Parts Supply Chain Execution

Muhammad Jalil, PhD Candidate, Rotterdam School of Management, Erasmus University, Room T9-19, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, MJalil@rsm.nl

We study supply chain execution of a spare parts inventory network. The customer base is heterogeneous with respect to the geographical locations and flexible service contracts. Demand is characterized by the time of arrival and part criticality. Following the quantity based revenue management approach, we devise a dynamic execution policy in order to fulfill the demand. The research is motivated by the spare parts logistics system of a major computer equipment manufacturer.

4 - Price and Service Competition in an Outsourced Supply Chain: The Impact of Demand Allocation Policies

Yue Jin, Bell Labs Ireland, Alcatel-Lucent, Blanchardstown Industrial Park, Blanchardstown, Dublin, 15, Ireland, yuejin@alcatel-lucent.com, Jennifer Ryan

We study the dual-sourcing problem faced by a buyer who outsources the manufacturing of a given product to two suppliers who compete on both price and service level. The buyer allocates demand to the suppliers using a two-dimensional score function and minimize his own costs. We characterize the optimal allocation policy for the buyer. For certain score function forms, we prove the existence of a unique equilibrium and characterize the equilibrium behavior of the system.

■ WB40

H-Sapphire H, Fourth Floor

Logistics and Information Systems

Contributed Session

Chair: Bogdan Bichescu, Assistant Professor, The University of Tennessee, 618 SMC, 916 Volunteer Blvd, Knoxville, TN, 37996, United States of America, bbichescu@utk.edu

1 - Activity Based Costing Approach for Third Party Logistics

Alp Avni Yelkenbicer, Izmir University of Economics, Ankara Caddesi no 261 BP, Bornova, Izmir, 35040, Turkey, alpavni@gmail.com, Burcu Ozcam Adivar

In this study we propose an Activity Based Costing (ABC) approach to help the management to form strategy, determine the policies, to control its operations and to evaluate the pricing decisions of a third party logistics company. By this approach, the company can compute costs caused by all processes, activities within those processes and assess the resource consumptions in those activities. Comparing the cost allocation before/after ABC structure, we analyze the pricing of logistics services.

2 - Commpetition and the Value of Additional Replenishment Opportunity

Yen-Ting Lin, The University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Campus Box 3490, McColl Building, Chapel Hill NC 27599, United States of America, linyt@email.unc.edu, Ali Parlakturk

We consider a manufacturer serving two competing retailers who sell their products during a selling season. The retailers place a regular order before the selling season begins. In addition to this initial order, quick response allows a retailer to place a second order after better demand is obtained. This paper examines the value of this additional ordering opportunity for the supply chain participants in the presence of retail competition.

3 - On the Use of Propensity Scoring to Detect Abnormal Performance

Bogdan Bichescu, Assistant Professor, The University of Tennessee, 618 SMC, 916 Volunteer Blvd, Knoxville, TN, 37996, United States of America, bbichescu@utk.edu, Melissa Bowers, Russell Zaretzki

Some recent empirical research in operations management has proposed the use of event-study methodology to determine the level of accounting-based abnormal operating performance induced by certain organizational events and decisions, such as supply chain glitches, product delays, plant closings, etc. This work examines the benefits of using propensity scoring methods to detecting abnormal performance, as an alternative to traditional benchmarking approaches used in the literature.

■ WB41

H-Sapphire L, Fourth Floor

Joint Session SPPSN/ MIF: Treating Emergency Medical Patients

Sponsor: Public Programs, Service, and Needs & Minority Issues Forum

Sponsored Session

Chair: Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W. Main Street, Box 843083, Richmond, VA, 23084, United States of America, lamclay@vcu.edu

1 - Optimal Control of an ER Triage and Treatment Process

Linda Green, Professor, Columbia University, Graduate School of Business, New York, NY, 10027, United States of America, lvg1@columbia.edu, Jingui Xie

In many health systems, patient care consists of two service phases: assessment and treatment. These may be performed by the same provider and so there's a question of how to prioritize work to balance initial delays for care with timely discharge of patients. We model a hospital emergency room as a tandem queue with a single server and finite capacity at the second stage. We explore alternative service disciplines under various scenarios and identify optimal policies for each.

2 - Statistical Analysis of Emergency Medical Services Data

Shane Henderson, Professor, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Dawn Woodard, David Matteson

Many operations research (OR) tools for EMS planning rely on estimates of call arrival rates and travel times. With a few notable exceptions, the statistical methods used to fit parameters such as these from EMS datasets are not ideal, leading to poor estimates of parameters and, potentially, poor results from the OR models. We explain why commonly used techniques are not ideal, and discuss our efforts to improve the situation.

3 - A Markovian Model for the Performance of an EMS System with Re-positioning

Ramon Alanis, University of Alberta, School of Business, University of Alberta, Edmonton, AB, T6G2R6, Canada, ramon@ualberta.ca, Bora Kolfal, Armann Ingolfsson

We present and analyze a two-dimensional Markovian model of an EMS system with rates that depend on state probabilities. We present an iterative algorithm to solve the model and investigate its convergence and we demonstrate the use of the model to estimate the effects of changes in repositioning policies.

4 - Fire Department Activities, Resources, and Needs Regarding EMS

John Hall, National Fire Protection Association, Quincy, MA, jhall@nfpa.org

Most emergency responses by U.S. fire departments are not for fires but for medical aid. Emergency medical service (EMS) not only has the largest share of fire department emergency responses but also a growing share. EMS carries its own requirements for training and equipment, and the fire department's involvement in EMS is running ahead of their resources. This presentation will provide an overview of relevant statistics.

5 - Evaluating Emergency Medical Service Performance Measures

Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W. Main Street, Box 843083, Richmond, VA, 23084, United States of America, lamclay@vcu.edu, Maria Mayorga

The ultimate goal of emergency medical service systems is to save lives. However, most emergency medical service systems have performance measures for responding to 911 calls in a fixed timeframe (i.e., a response time threshold), rather than measures related to patient outcomes. This paper proposes a methodology for evaluating the performance of response time thresholds in terms of resulting patient survival rates. Results are illustrated using real-world data.

■ WB42

H-Sapphire P, Fourth Floor

Supply Chain Management I

Contributed Session

Chair: Seunghwan Kim, Visiting Assistant Professor, University of Illinois at Urbana-Champaign, 355 Wohlers Hall, 1206 S.6th St., Champaign, IL, 61820, United States of America, ethankim@illinois.edu

1 - Lower-bound-driven Heuristics in Equipment Overhaul Operations

Collin Chan, PhD Student, School of Operations Research and Information Engineering, Cornell University, 257 Rhodes Hall, Ithaca, NY, 14853, United States of America, csc45@cornell.edu, Huseyin Topaloglu, Peter Jackson, John Muckstadt

Correlated demands for service parts arise in equipment overhaul operations, such as jet engine repair. In addition, lateness penalties increase with the length of delay. Procurement planning and stock allocation are formulated as a stochastic dynamic program. We use decomposition techniques to develop lower bounds on the optimal value function. These lower bounds give rise to dynamic heuristic policies whose performance we evaluate empirically.

2 - Optimal Ordering Policy with MOQ Constraints and Information Updating

Linda Chow, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, Hong Kong - PRC, linda.chow@polyu.edu.hk, T.C. Edwin Cheng, Jason Choi

We study in this paper a dynamic optimization inventory problem with a fashionable product. With information updating and a dual ordering flexibility, we study the optimal ordering policy when there are "minimum ordering quantity (MOQ)" constraints. Impacts brought by the use of information as well as the MOQs are discussed.

3 - Optimizing Backorder Lead-time in a Supply Chain with Partial Backlogging and Stochastic Demand

Hwansik Lee, Auburn University, 1355 Commerce Dr. #1204, Auburn, AL, 36830, United States of America, leehwan@auburn.edu, Chan S. Park

We examine a backorder lead-time optimization in a two-stage system with time-dependent partial backlogging and stochastic demand. Backordering cost is often regarded as a constant in literature. However, the backorder cost and rate are characterized as a function of response time in a real situation. A representative expected cost function and the closed form optimal solution are derived. We also illustrate our results (e.g., cost savings) with an example.

4 - Customer Lead Time and Inventory Management Using a Multi-point Push-pull Supply Chain Design

Seunghwan Kim, Visiting Assistant Professor, University of Illinois at Urbana-Champaign, 355 Wohlers Hall, 1206 S.6th St., Champaign, IL, 61820, United States of America, ethankim@illinois.edu

We present a concurrent supply chain design framework of products, processes and organizational forms with a new hybrid push-pull model which can incorporate multiple inventory stock points with different levels of postponement. A comparison with the conventional push-pull model is given and some insights on the impact of having multiple inventory points with multiple level of postponement to designing push-pull supply chains and customer lead time management are provided.

■ WB43

H-Room 400, Fourth Floor

Approximate Dynamic Programming for Supply Chains

Cluster: Supply Chain Models

Invited Session

Chair: Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu

1 - Computing Near Optimal Policies in Generalized Joint Replenishment

Dan Adelman, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, United States of America, dan.adelman@chicagobooth.edu, Diego Klabjan

We provide a practical methodology for solving the generalized joint replenishment (GJR) problem. We show how to automatically generate a value function approximation basis built upon piecewise-linear ridge functions, by developing and exploiting a theoretical connection with the problem of finding optimal cyclic schedules. We provide a variant of the algorithm that is effective in practice, and exploit the special structure of the GJR problem to provide a coherent, implementable framework.

2 - An Approximate Dynamic Programming Approach to the Economic Lot Scheduling Problem

Christiane Barz, University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, Christiane.Barz@chicagobooth.edu, Dan Adelman

We formulate the economic lot scheduling problem with sequence-dependent setup times and costs as a semi-MDP. An affine approximation of the bias function gives a semi-infinite LP determining a lower bound for the minimum average cost rate. Under a mild condition, we can reduce this problem to a small convex quadratically constrained linear problem, which is equivalent to the lower bounds of Dobson (1992) and Bomberger (1966). We thus unify previous work, and open new paths for future research.

3 - Approximate Dynamic Programming for Management of High Value Spare Parts

Hugo Simao, Research Staff, Princeton University - CASTLE Lab, Sherrerd Hall 112, Princeton, NJ, 08544, United States of America, hpsimao@princeton.edu, Warren Powell

An aircraft manufacturer needs to allocate inventory to a set of distributed warehouses in response to random, increasing demands. Some spare parts have high value and low frequency demand. The objective function involves maximizing net contribution, while keeping a minimum level of service and a maximum capital invested. The problem is solved using approximate dynamic programming (ADP), with a new approach for approximating value functions in the presence of low frequency observations.

4 - Approximate Dynamic Programming for a Dynamic Job Scheduling Problem

Huseyin Topaloglu, Cornell University, School of ORIE, Rhodes Hall, Ithaca, NY, 14853, United States of America, ht88@cornell.edu, Alexander Erdelyi

We consider a job scheduling problem where jobs of different priority levels that arrive randomly over time have to be scheduled for different days of the planning horizon. We have limited capacity on each day and jobs waiting to be processed incur a holding cost. We show how to exploit a simple deterministic linear programming formulation of the problem to construct separable piecewise-linear value function approximations. Our computational work indicates that our approach performs quite well.

■ WB44

H-Room 402, Fourth Floor

Development of Product-Service Systems

Sponsor: Service Science

Sponsored Session

Chair: Kwang-Jae Kim, Professor, POSTECH, Industrial and Management Engineering, Pohang, KB, 790-784, Korea, Republic of, kjk@postech.ac.kr

1 - Key Success Factors of Product-Service System

Kwangtae Park, Professor, Korea University, Seoul, Korea, Republic of, ktpark@korea.ac.kr, Kwang-Jae Kim, Yoo S. Hong, Jinmin Kim, Jiyoung Wang

The objective of this study is to find key success factors of four companies which achieved successful service innovation. We first introduce the concept of Product-Service Systems(PSS) and present four companies based on classification framework of Schmenner's service process matrix. We then analyze four companies through the binding platform of customer utility map and value curve. The result of this study will be useful for companies to find new sources of service innovation.

2 - A Scenario-based Product-service System Concept Development Framework for Designing New Experiences

Yoo S. Hong, Assistant Professor, Seoul National University, 599 Kwanakro, Kwanakgu, Seoul, 151-744, Korea, Republic of, yhong@snu.ac.kr, Changmuk Kang, Jun-Suk Park, Ji Hwan Lee, Min Jung Baik, Se-Jun Min

Product-service system (PSS) is a novel name for the system which delivers new experiences combining products and services. In this study, a scenario-based framework and representation models for developing a PSS concept is proposed. This framework generates various scenarios, each of which describes how a stakeholder achieves his/her own value via interacting with a PSS, and derives a concept by aggregating those scenarios. An example case for a diabetic-care system is also presented.

3 - Testing of Product-related Services

Thomas Meiren, Head of New Service Development, Fraunhofer IAO, Nobelstr. 12, Stuttgart, 70569, Germany, Thomas.Meiren@iao.fraunhofer.de, Thomas Burger

In the last years, far greater attention has been accorded to new service development by researchers and businesses alike. However, if the suggestions and approaches for developing new services are considered it is conspicuous that testing of development results has been largely neglected in the past. The presentation shows how testing of product-related services can be realized and presents possible techniques for simulating services, e.g. with the help of virtual reality and service theater.

4 - Ideation Support System for Product-Service System Development

Kwang-Jae Kim, Professor, POSTECH, Industrial and Management Engineering, Pohang, KB, 790-784, Korea, Republic of, kjk@postech.ac.kr, Chi-Hyun Lim, Jin Lee, Dong-Hee Lee, Yoo S. Hong, Kwangtae Park

This paper presents a systematic guideline to support the idea generation for new product-service systems (PSS). The models and strategies of existing PSS cases are analyzed, and the insights extracted from the analysis are used to facilitate the idea generation process. The generated PSS ideas can serve as a basis for developing new PSS concepts.

■ WB45

H-Room 410, Fouth Floor

Management of Technology

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 - EVAT: A Platform for Enterprise Viability Analysis and Prediction

Olusola Oduntan, Wayne State University, 4510 Fourth Street, Detroit, MI, United States of America, soduntan@gmail.com, Namkyu Park

Enterprise Viability Analysis Test-bed (EVAT) is a platform for conducting experiments in enterprise viability under turbulence. Based on Axiomatic Design, Viable System Model (VSM), and Agent Based Modeling, we review its application in analyzing management scenarios in product innovation, advertising, and evaluate viability trade-offs between product innovation and advertising emphasis.

2 - Cross-border Absorption of Technological Knowledge: Co-evolution of HQs and R&D Subsidiary

Seiko Arai, assistant professor, National University of Singapore, 7 Engineering Drive 1, E3A, #11-05, E3A, #11-05, Singapore, Singapore, etmas@nus.edu.sg

This paper examines the cross-border intra-firm absorption and creation of technological knowledge; in particular, the process of organizational changes of multinational companies (MNCs) and the mechanism that enables the absorption and creation of foreign technologies through R&D subsidiary. Because of the exploratory nature, this study relies on a case study method and grounded theory approach.

3 - Models of Knowledge Management in the Transformation of Government Organizations

Elie Geisler, Distinguished Professor, Stuart School of Business Illinois Institute of Technology, 565 W. Adams Street, Chicago, IL, 60661, United States of America, geisler@stuart.iit.edu

Government organizations are experiencing major challenges and structural as well as mission transformations. What is the role of knowledge management in these changes? This paper examines the models and metrics for success of knowledge management in the reorganization of public agencies. Health care agencies are used as an illustration.

4 - Internal versus External Innovation Strategy and Firm Performance

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, Kevin Zhu

This paper investigates innovation strategy of internal R&D versus external acquisition, and its relation to firm performance. With firm-level data from 15 European countries, our empirical analysis shows that vertical versus horizontal cooperation plays different role in innovation strategy. Further, innovation strategy and its effect on firm performance are sensitive to industry characteristics and environmental contexts.

■ WB46

H-Room 411, Fourth Floor

Technology, QFD and Logistics Services

Sponsor: Technology Management
Sponsored Session

Chair: Juliana Hsuan, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK, 2000, Denmark, jh.om@cbs.dk

1 - Technology Outsourcing

Rosine Hanna, PhD Student, Portland State University, Department of Engineering and Technology Man, Maseeh College of Engineering and Compu, Portland, OR, 97207-0751, United States of America, rosine@pdx.edu, Tugrul Daim

This study presents a model that facilitates understanding the challenges of outsourcing technology service and knowledge processes. The model identifies the vital challenges for such policies It provides a sequential view of constructing firms' capability in the technology service sector. A number of frameworks were created to clarify sourcing options and help decision makers in choosing which processes to outsource and which to in-source.

2 - Integrating QFD and Knowledge Perceptual Map into a Bio-energy Technology Roadmap

Ann-Marie Lamb, PhD Student, Engineering & Technology Management, Portland State University, Portland, United States of America, ajlamb@pdx.edu, Tugrul Daim, Scott Leavengood

This paper shows an application of strategic bio-energy industry technology roadmapping. Focus is on how two tools; quality function deployment and knowledge perceptual map, were combined to form a technology roadmap for wood pellet market drivers, technology, product, resources, and partnerships.

3 - A Dynamic Programming Model for Project Selection with Unknown Return and Investment Characteristics

Senay Solak, Assistant Professor, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@som.umass.edu, Mehmet Gumus

We consider a firm allocating its resources to a set of projects or technologies. Facing stochastic returns with unknown parameters, the firm needs to decide on both which projects to select and how much to invest on the selected projects with the objective of maximizing total expected discounted profit. A dynamic programming formulation is proposed and some numerical results are presented.

4 - Service and Process Structures in Logistics Services

Anu Bask, Senior Advisor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, anu.bask@hse.fi, Mervi Rajahonka, Markku Tinnila

This paper focuses on current state and future prospects of logistics services. Based on semi-structured company interviews we discuss service and process structures and their development, and how modularity can be perceived in logistics services. Results show that companies intuitively suggest that using modularity related to services would bring benefits.

■ WB47

H-Room 412, Fourth Floor

Marketing I

Contributed Session

Chair: Jayprakash Patankar, Professor of Management, The University of Akron, Department of Management, College of Bus. Administration, Akron, OH, 44325-4801, United States of America, jgp@uakron.edu

1 - Weather Marketing: A Case Study of Consumer Behavior and Sales Analysis

Takashi Namatame, Associate Professor, Senshu University, 2-1-1 Higashimita, Tama-ku, Kawasaki, Kanagawa, 214-8580, Japan, takashi@isc.senshu-u.ac.jp, Tomoaki Tabata, Noriyuki Suyama

Weather is one of important factors for sales change of retail shop. Much knowledge about weather marketing is shown from the view of business. However, there are not so many academic studies about weather marketing. In this study, we show a general concept for analyzing weather marketing with consumer behavior. Moreover, we analyze weather effect and consider the change of consumer behavior and sales effect of weather change with a real POS data of Japanese supermarket.

2 - The Moderating Role of "RMO" on "MO" and Business Performance Linkage in Service Context

Jashim Khan, Lecturer, Auckland University of Technology, Wellesley St, Campus, Auckland, Nt, 1026, New Zealand, jashim.khan@aut.ac.nz

This paper explores the blend of relationship marketing orientation (RMO) and market orientation (MO) in service sector by controlling the direct impact of RMO on business performance model. It is a descriptive and theoretical analysis, and thus secondary data from previous studies are used as comparative analysis for examination and discussion. The findings indicate that "RMO" strengthens "MO" and business performance linkage among service firms. .

3 - Determinants of Purchase Intentions for Cell Phones Among College Students

Lemaro Thompson, MBA Student, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, lthomps5@student.savannahstate.edu, Ulysses Brown

This research explores the purchase intentions and its antecedents among college students in the cell phone industry. Using structural equation modeling to evaluate the hypotheses, we examine the factors that influence purchasing intentions and brand loyalty. Findings indicate that dispositional constructs influence both outcome variables in our model.

4 - B2B Customer Recommendations Based on a Planned Purchasing Prediction Model

Lynd Bacon, President, Loma Buena Associates, P.O. Box 620960, Woodside, CA, 94062-0960, United States of America, lbacon@lba.com, Peter Lenk, C. Michael Troutman, Ashwin Sridhar

We describe a model-based sales support system that assumes customers periodically review their inventory levels, reorder when levels fall below preset points and based on expected future demands. Our model derives inter-order time distributions as functions of time-varying previous demand. We use hierarchical Bayes methods to make predictions for a large number of SKUs, estimate splined demand functions, incorporate effects of sales calls, and accommodate customer heterogeneity.

5 - Optimum Premium to Insure Shipments by Logistics Organizations

Jayprakash Patankar, Professor of Management, The University of Akron, Department of Management, College of Bus. Administration, Akron, OH, 44325-4801, United States of America, jgp@uakron.edu, Amitava Mitra

Suppliers of parts or sub-assemblies may be geographically dispersed, which necessitates delivery of shipped goods in an un-damaged condition. Here, we assume that the propensity of a customer to insure a shipment is based on its value. Optimum premium to charge for such insurance is determined.

■ WB48

H-Sapphire Green Room, Fourth

Advances in Appointment Scheduling under Uncertainty

Cluster: Service Operations Management
Invited Session

Chair: Stephen Lawrence, Associate Professor, University of Colorado, Leeds School of Business, 419 UCB, Boulder, CO, 80309-0419, United States of America, Stephen.Lawrence@colorado.edu

1 - Traditional vs. Open-access Appointment Scheduling with Multiple Sources of Uncertainty

Rachel Chen, Assistant Professor, University of California at Davis, rachen@ucdavis.edu, Lawrence W. Robinson

This paper uses stochastic programming to compare traditional and open-access appointment scheduling policies in the presence of multiple sources of uncertainty, including random service times, patient no-shows, and unscheduled walk-ins. We examine the degree to which these uncertainties affect the relative efficacy of these two scheduling policies.

2 - Optimal Outpatient Scheduling with Emergency Arrivals

Paulien Out, PhD Student, VU University, De Boelelaan 1081a, 1081 HV, Amsterdam, Netherlands, pot300@few.vu.nl, Ger Koole

We present an efficient method for scheduling outpatient appointments to a facility with emergency arrivals. A weighted sum of the waiting times, idle times and tardiness is minimised. No-shows are allowed. We assume Poisson arrivals for emergency patients and general iid service times. We will present numerical examples.

3 - Appointment Scheduling with Variable Service Times

Stephen Lawrence, Associate Professor, University of Colorado, Leeds School of Business, 419 UCB, Boulder, CO, 80309-0419, United States of America, Stephen.Lawrence@colorado.edu, Linda Laganga

We extend previous results regarding appointment scheduling in health care clinics to include appointments with variable service times. Our algorithm allows a clinic to schedule patient appointments so that aggregate clinic utility is maximized, balancing clinic productivity benefits with patient waiting and clinic overtime penalties. Computational experiments demonstrate the efficacy of our algorithm.

■ WB49

H-Room 300, Third Floor

Design and Analysis of Distribution Supply Chains

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Srinagesh Gavirneni, Cornell University, sg337@cornell.edu

1 - An Analysis of Coordination Mechanisms for the U.S. Cash Supply Chain

Mili Mehrotra, PhD Student, The University of Texas at Dallas, 800 West Campbell Road, School of Management, Richardson, United States of America, mxm057000@utdallas.edu, Milind Dawande, Vijay Mookerjee, Chelliah Sriskandarajah

Through its new cash re-circulation policy, the Federal Reserve of the United States intends to induce Depository Institutions to effectively re-circulate cash so that the societal cost of providing cash to the public is minimized. We first analyze the efficacy of the Fed's current policy as a coordinating mechanism and then propose and analyze a fundamentally different mechanism.

2 - An Assessment of the Effects of Different Inventory Record Inaccuracy

Thomas Kull, Assistant Professor, Arizona State University, P.O. Box 874706, Tempe, AZ, 85287-4706, United States of America, Thomas.Kull@asu.edu, Elliot Rabinovich, Mark Barratt

Issues related to inventory record inaccuracy (IRI) have gained interest, yet research is needed regarding IRI in distribution operations and on the dynamics of IRI. We consider effects on a distributor-retailer dyad experiencing various dynamic IRI patterns. Using observations from a DC, we build a discrete-event simulation, conduct experiments and test if IRI patterns have expected effects. Implications are drawn for managers while suggesting methods for improvement.

3 - Using Retailer Order Commitments to Improve Supply Chain Performance

Lawrence W. Robinson, Associate Professor of Operations Management, Cornell University, Johnson Graduate School of Management, 433 Sage Hall, Ithaca, 14853, United States of America, lwr2@cornell.edu, Srinagesh Gavirneni

We evaluate the effectiveness of order commitment policies in decentralized supply chains, and establish that these strategies are effective whenever the supplier's cost is at least 29.3% of the total supply chain cost. This benefit increases as the supplier's share of the total supply chain cost increases. Order commitment policies will be more effective when end-customer demands are positively correlated across retailers, and less effictive when they are are positively correlated across time.

■ WB50

H-Room 302, Third Floor

Lot Sizing I

Contributed Session

Chair: Changyuan Yan, Drexel University, Rm 229, 101N 33rd St, Philadelphia, PA, 19104, United States of America, cy66@drexel.edu

1 - A Relaxation Approach for Solving the Stochastic Lot Sizing Problem with Service Level Constraints

Ulas Ozen, Researcher, Alcatel-Lucent / Bell Labs, Alcatel-Lucent, Blanchardstown Industrial Park, Dublin, 15, Ireland, uozen@alcatel-lucent.com, Armagan Tarim, Mustafa Kemal Dogru, Roberto Rossi

This paper provides an efficient computational approach to solve a mixed integer programming model developed for calculating the parameters of an (R,S) policy

in a finite horizon with non-stationary stochastic demand and service level constraints.

2 - Faster Primal-dual Algorithms for the Economic Lot-sizing Problem

Dan Stratila, RUTCOR, Rutgers University, 640 Bartholomew Rd, Rm 107, Piscataway, NJ, 08854, United States of America, dstrat@rci.rutgers.edu, Mihai Patrascu

Consider the classical lot-sizing problem, introduced by Manne (1958), and Wagner and Whitin (1958). Since its introduction, researchers have worked on faster algorithms for it. Federgruen and Tzur (1991), Wagelmans et al (1992), and Aggarwal and Park (1993) independently obtained O(n log n) algorithms. Recently, Levi et al (2006) developed a primal-dual algorithm. Building on the work of Levi et al, we obtain a fast primal-dual algorithm for the lot-sizing problem and analyze its running time.

3 - ATSP-based Models for a Synchronized Lot Sizing and Scheduling Problem at the Soft Drink Industry

Deisemara Ferreira, Universidade Federal de Sao Carlos, Rod. Washington Luis - Km 235, Sao Carlos, Brazil, deise@dep.ufscar.br, Alistair Clark, Bernardo Almada Lobo, Reinaldo Morabito

We present novel formulations based on the travelling salesman problem to solve a lot sizing and scheduling problem arising in the soft drink industry. Computational experiments show a remarkable improvement of the solutions obtained by the proposed models over real-world industrial solutions.

4 - Economic Lot Sizing Problem with Perishable Items

mehmet onal, Florida International University, 10555 West Flagler Street, Miami, FL, 33131, United States of America, monal@ufl.edu, Edwin Romeijn

We consider an extension of the classical dynamic economic lot sizing problem where items perish in a certain number of periods. This number can depend on the period in which the item was procured and the supplier it was procured from. We distinguish between (i) settings in which the retailer has the power to supply customer demands in each period with any non-perished items, and (ii) settings in which the customer has the power to select from the collection of available items.

5 - An Integrated Lot Sizing Model for Deteriorating Items

Changyuan Yan, Drexel University, Rm 229, 101N 33rd St, Philadelphia, PA, 19104, United States of America, cy66@drexel.edu, Yi Liao, Avijit Banerjee

The objective of this study is to develop an integrated 2-echelon lot sizing model for a deteriorating item. With an infinite production rate, we relax the traditional assumption of a low deterioration rate and develop a methodology for obtaining an exact optimal solution. A numerical example illustrates our proposed approach.

■ WB51

H-Room 303, Third Floor

Engineering Applications of Stochastic Programming

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Victor M Zavala, Postdoctoral Researcher, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov

1 - On the Improvement of the Call Center Arrival Rate Prediction by Incorporating the Weather Forecast

Hideki Yamanaka, Fujitsu Laboratories Ltd., 4-1-1 Kamikodanaka, Nakahara-ku, Kawasaki, 211-8588, Japan, hyamanaka@jp.fujitsu.com

Since the number of call center agents mostly determining the cost of their center is derived from an arrival rate prediction, the improvement of its precision is crucial. However it is hard for usual approaches to improve the precision further, we focused on the change of customers' dialing behavior caused by the degree of rain fall and developed a new arrival rate prediction tool incorporating the customer population and the weather forecast of each region.

2 - New Product Development Planning Using Stochastic Programming

Christos Maravelias, Assistant Professor, University of Wisconsin - Madison, 1415 Engineering Drive, Madison, WI, 53562, United States of America, christos@engr.wisc.edu, Matthew Colvin

We present a multi-stage stochastic programming formulation for the planning of research and development (R&D) activities, with an emphasis in the pharmaceutical pipeline. We discuss aspects such as outlicensing, resource planning, and we develop a) theoretical properties that allow us to formulate smaller and tighter models, b) an infinite-horizon approximation, c) a novel branch-and-cut algorithm, and d) a rolling horizon approach.

3 - Optimal Operation and Contract Planning under Uncertainty with Rigorous Models for Air Separation

Carl Laird, Assistant Professor, Texas A&M University, United States of America, carl.laird@tamu.edu, Yu Zhu

We study the optimal planning and operation using a rigorous model of a cryogenic air separation system with multiple uncertain product demands. Loss functions are adopted to evaluate the expectation of plant profit and formulate a probabilistic fill rate constraint for contractual responsibilities. Single and multiple period formulations are solved by means of our recently developed parallel nonlinear programming algorithm.

4 - Risk Management for a Global Chemical Supply Chain

Fengqi You, Graduate Student, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, yfq@cmu.edu, Ignacio Grossmann

In this work, we consider the risk management of a global multi-product chemical supply chain under various uncertainties. We will discuss the model formulation, computational strategies and simulation method. Real-world industrial applications with up to 12,000 uncertain parameters are investigated, and the economic benefits of considering uncertainties are also illustrated.

5 - Uncertainty Quantification and Stochastic Programming for Weather Forecast-Based Operations

Victor M Zavala, Postdoctoral Researcher, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov, Mihai Anitescu

In this talk, we summarize recent developments in the area of weather forecast-based optimization of industrial systems. We discuss issues related to the integration of advanced weather forecast models, uncertainty quantification techniques, and on-line stochastic programming algorithms. Numerical simulation studies are used to illustrate the economic benefits of the proposed framework.

■ WB52

H-Room 304, Third Floor

New Topics on OM/Marketing Interface

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Max Shen, Professor, University of California-Berkeley, Dept of IEOR, Berkeley, CA, 94704, United States of America, shen@ieor.berkeley.edu

Co-Chair: Shan Li, PhD Candidate, University of California-Berkeley, Dept of IEOR, Berkeley, CA, United States of America, lisapine@berkeley.edu

1 - Revenue Management with Strategic Customers: Last Minute Selling and Opaque Selling

Kinshuk Jerath, Assistant Professor of Marketing, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, kinshuk@andrew.cmu.edu, Serguei Netessine, Senthil Veeraraghavan

Using a stylized economic model, this paper attempts to explain and compare the benefits of last-minute sales directly to consumers vs. through an opaque intermediary (such as Hotwire or Priceline), which hides some attributes of the tickets it sells.

2 - Incorporating Social Contagion into Cusotmer Lifetime Value Analysis

Shan Li, Ph.D. Candidate, University of California-Berkeley, Dept of IEOR, Berkeley, CA, United States of America, lisapine@berkeley.edu, Max Shen, Teck-Hua Ho

In this talk, we present a model to characterize customer lifetime value in terms of their purchase value and their influential value induced by word-of-mouth communication. We then propose an effective sample distribution scheme and show how businesses should launch market activities by taking customer lifetime value into account.

3 - A Multi-category Model of Physician Prescriptions and Detailing

Xiaojing Dong, Santa Clara University, Lucas Hall, 500 El Camino Real, Santa Clara, CA, 95053, United States of America, xdong1@scu.edu, Pradeep Chintagunta, Puneet Manchanda

An important issue facing firms marketing several prescription drugs in different categories to the same physicians is to understand the responsiveness of these physicians to detailing across categories. In this paper we propose a multicategory model of prescription while accounting for the endogeneity of firms' detailing efforts. From a substantive perspective, we are able to quantify the impact of a multicategory analysis when segmenting physicians based on their responsiveness to detailing.

4 - Co-evolution of Demand & Supply under Competition. New Insights in Market Segmentation Dynamics

Ben Vermeulen, PhD candidate, Eindhoven University of Technology, Dep. of Ind.. Eng. & Innov. Sc., P.O. Box 513, Eindhoven, 5600 MB, Netherlands, b.vermeulen@tue.nl, Ton de Kok

Although co-evolution of demand and supply under competition is conceptually encompassing, we find a simple implementation by synthesizing a technology substitution model and a production control model. We then study the role of production scaling responsiveness and product attractiveness in market segmentation dynamics. We obtain insights in the role of technological performance, entry time, scaling and pricing strategies in realizing market dominance or quasistable market segmentation.

■ WB53

H-Room 305, Third Floor

Joint Session Optimization/MIF: Branchwidth, Treewidth, and Integer Programming! Oh, my!!

Sponsor: Optimization/Integer Programming & Minority Issues Forum

Sponsored Session

Chair: Illya Hicks, Associate Professor, Rice University, 6100 Main St. - MS 134, Houston, TX, 77005-1892, United States of America, ivhicks@rice.edu

1 - A Branch-and-price-and-cut Approach for Determining the Optimal Bramble Number

Sibel Sonuc, University of Florida, P.O. Box 116595, Gainesville, United States of America, sibel.bilge@ufl.edu, Cole Smith

In this study, we investigate a methodology to find the bramble number of a given graph. We investigate a branch-and-price-and-cut algorithm to solve this problem. However, both columns and rows must be added to the master problem at each iteration. We model the not-yet-generated rows as hidden rows with unknown associated dual values. A dual value of zero is valid for these rows, but the generation of degenerate (and useless) columns can be avoided by examining a space of optimal dual values.

2 - Near Optimal Branch Decompositions for Linear Matroids

Illya Hicks, Associate Professor, Rice University, 6100 Main St. - MS 134, Houston, TX, 77005-1892, United States of America, ivhicks@rice.edu, Jing Ma

The notions of branch decompositions and branchwidth were introduced by Robertson and Seymour in their proof of the Graph Minors Theorem. Later, Dharmatilake extended these notions to matroids. In this vein, we present a polynomial-time heuristic to compute near optimal branch decompositions of linear matroids. The heuristic utilizes diffusion regularization and techniques of partially-labeled classification. We offer some theoretical and computational results.

3 - Computational Results on the Cunningham-Geelen Algorithm for solving Integer Programs

Susan Margulies, Post-doc, Rice University, 6100 Main Street, Houston, TX, 77005, United States of America, susan.margulies@rice.edu, Illya Hicks, Jing Ma

Consider the integer program max(c^Tx : Ax = b, x >= 0,) where A is non-negative and the column-matroid of A (denoted by M(A)) has constant branch width. Cunningham and Geelen introduced a pseudo-polynomial time algorithm for solving this integer program that takes a branch decomposition T of M(A) as input. We report on computation results of a C++ implementation of this algorithm.

■ WB54

H-Room 306A, Third Floor

Approximation Algorithms

Sponsor: Optimization/Networks

Sponsored Session

Chair: Yury Makarychev, TTI-Chicago, 6045 S. Kenwood Ave, Chicago, IL, 60637, United States of America, ymakarychev@gmail.com

1 - Unique Games on Expanding Constraint Graphs are Easy

Alexandra Kolla, Postdoctoral Researcher, Institute for Advanced Study, 2233 Filbert st, San Francisco, CA, 94123, United States of America, akolla@cs.berkeley.edu, Subash Khot, David Steurer, Madhur Tulsiani, Nisheeth Vishnoi, Sanjeev Arora

We present two efficient algorithms to find a good solution to the Unique Games problem when the constraint graph is an expander. We introduce a new analysis of the standard SDP in this case that involves correlations among distant vertices. It also leads to a parallel repetition theorem for unique games when the graph is an expander. We also present a spectral partitioning algorithm for the problem.

2 - Maximum Independent Set of Rectangles

Parinya Chalermsook, Student, University of Chicago, 1100 E 58th st, Chicago, IL, United States of America, parinya@uchicago.edu, Julia Chuzhoy

We study the Maximum Independent Set of Rectangles (MISR) problem: given a collection of n axis-parallel rectangles, find a maximum-cardinality subset of disjoint rectangles. MISR has many applications ranging from map labeling to data mining. In this talk, we show an $O(\log \log n)$-approximation algorithm for MISR. Our algorithm combines the approaches for solving special cases of the problem with new insights into the combinatorial structure of sets of intersecting rectangles in the plane.

3 - Set Covering with Our Eyes Closed

Mohit Singh, Microsoft Research, New England. One Memorial Drive,. Cambridge, MA 02142, USA, mohsingh@microsoft.com

In this paper, given a set cover instance with m sets over a universe of size n, we show that you can associate each element with some set covering it, so that if a random subset S of elements arrives, the expected cost of using the sets associated with elements of S to cover the subset S is only O(log mn) times the expected optimum. The techniques also extend to stochastic online versions of facility location and the multi-cut problem. We also show matching lower bounds for these problems.

■ WB55

H-Room 306B, Third Floor

Vehicle Routing I

Contributed Session

Chair: Li Jian, Nanjing Agricultural University, College of Engineering, 95#, Nanjing, 210031, China, telorance@126.com

1 - Time-dependent Elevator Dispatching Problem

Janne Sorsa, Manager, R&D, High Rise Competence Center, KONE Corporation, Keilasatama 3, Espoo, 02150, Finland, janne.sorsa@kone.com, Harri Ehtamo

Elevator Dispatching Problem is a dynamic pick-up and delivery problem where future transportation requests are not known when making dispatch decisions. It is also a stochastic problem since passenger arrivals are assumed to follow Poisson process. We shall formulate the problem as a bilevel optimization problem and show its special time-dependent structure. This kind of time-dependency has not been studied in the literature of routing problems, which also makes the problem non-linear.

2 - Model and Algorithm for Solving Static Dial-a-ride Problem Considering Time Varying Travel Times

Taehyong Kim, Dept of Civil&Environmental Eng., 1173 Glenn L. Martin Hall, University of Maryland, College Park, MD, 20740, United States of America, tommykim@umd.edu, Ali Haghani

This paper studies a static dial-a-ride problem with time varying travel times, multiple depots, and heterogeneous vehicles. In this paper, a static DARP model is formulated and several random small network problems are solved using commercial optimization package, CPLEX. A heuristic methodology is proposed to solve this problem within a reasonable time for implementation in a real-world situation. The model is used to solve a real world problem that is provided by the MTA in Baltimore, MD.

3 - Mixed Vehicle Routing Problem with Dynamic Reverse Demands

Li Jian, Nanjing Agricultural University, College of Engineering, 95#, Nanjing, 210031, China, telorance@126.com

Mixed vehicle routing problem with dynamic reverse demands and time windows (MVRPDT) is studied, in which the dispatcher does not have any deterministic or probabilistic information on the appearing time, serving time, location and demand of the reverse customer order until it arrives. MVRPDT is devided into static and dynamic phases and each phase is respectively solved by record-to-record travel algorithm.

■ WB56

H-Room 307, Third Floor

Pricing and Revenue Management I

Contributed Session

Chair: Amir-Behzad Samii, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Zaragoza, Spain, absamii@mit.edu

1 - Optimized Pricing and Distribution in B2C Truck Rental

Ivette Arambula, Senior Scientist, PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, iarambula@prospricing.com

We consider the business and logistics problem of determining optimized prices to be offered to the market to satisfy rental demand subject to availability of inventory and considering the option of moving inventory at a cost. We model it

as a network flow optimization to maximize profit given the calculated projected demand, current inventory and distribution costs. We summarize profit lift results compared with existent business practices for one of the US leading companies in the industry.

2 - Transportation Cost Allocation to Customers in the Industrial Gas Industry

Hua Han, PhD Candidate, University at Buffalo, University at Buffalo, 308A Bell Hall, Department of Industrial and System Eng, Buffalo, NY, 14260-1900, United States of America, huahan@buffalo.edu, Mark Karwan

Industrial gas industry routes for liquid product typically involve one to four customers. How to allocate route costs to each customer fairly is a difficult problem. Based on game theory, Patel and Savelsburgh developed a 'moat' model to allocate costs. We modify this model to handle a number of realities by adding new constraints and further steps to balance the concepts of marginal cost and the game theory coalition philosophy. Some examples are discussed and a flow chart is given.

3 - Service Levels in Standard and Theft Nesting Capacity Allocation Mechanisms

Amir-Behzad Samii, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Zaragoza, Spain, absamii@mit.edu, Richard Pibernik, Prashant Yadav

In a service differentiated and uncertain demand environment, the proper allocation of capacity to customer classes is of utmost importance. We provide closed form solutions for service level measures in a two-class single-period resource reservation problem; using Standard and Theft Nesting allocation mechanisms. We show that under which capacity and demand rate conditions one mechanism dominates the other. The optimal reserved quantity can then be decided accordingly.

■ WB57

H-Room 308, Third Floor

OR Applications in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Hao Zhang, University of Maryland, 6802 Harrowdale Road, Baltimore, MD, 21209, United States of America, hzhan001@umaryland.edu

1 - The Development and Assignment of Service District Boundaries for Long-Term Health Service Liaisons

Ashlea Bennett, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, ashlea@gatech.edu

Organizations that provide case management services to the homebound elderly and chronically ill population assign case managers to manage the long-term health needs of each patient. The case managers split their time between a central office and the patients' homes. We study the development of case manager service district boundaries, such that case loads are maximized, balanced across personnel, and continuity of patient-manager relationships is preserved.

2 - The Operational and Financial Implications of Physician Extenders

Denise White, University of Cincinnati, 2925 Campus Green Dr, Cincinnati, OH, 45221-0130, United States of America, whited5@email.uc.edu, Craig Froehle

The best approach to using a physician extender (PE) in an outpatient clinic depends on various operating characteristics. Using simulation, we identify a set of policy guidelines that maximize operating performance and/or clinic profits. Some results are counterintuitive. Our findings have already shaped how one practice runs its clinics.

3 - Building Cyclic Schedules for Emergency Room Physicians

Yann Ferrand, PhD student, University of Cincinnati, Department of QAOM, Campus Green Drive, Cincinnati, OH, 45221, United States of America, ferrany@email.uc.edu, Michael Magazine, Uday Rao, Todd Glass

Physicians at a branch emergency department complain their current schedule is too erratic, due to the multitude of regulatory constraints, physician preferences and holiday requests. We develop an integer program to address this issue by building cyclic schedules that can be repeated throughout the year. We incorporate holidays and vacations ex post and capture statistics on performance of the schedules. Implementation includes interactions with the main emergency department.

4 - Age Stratified Risk Prediction of Invasive versus In-situ Breast Cancer: A Logistic Regression Model

Mehmet Ayvaci, University of Wisconsin-Madison, 3239 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, Ayvaci@wisc.edu, Jagpreet Chhatwal, Oguzhan Alagoz, Elizabeth Burnside, Edward Sickles, Mary Lindstrom

We developed a logistic regression model for prospective differentiation of DCIS versus invasive breast cancer. Our model is based on demographic risk factors and mammography descriptors in both structured and free-text format and performs superiorly in older women. A computerized decision aid, such as ours, that can accurately predict the type of breast cancer can empower older women to better manage their breast health in the context of their co-morbidities and life expectancy.

5 - Optimal Design of an Appointment Scheduling System under Patient No-shows

Nan Liu, University of North Carolina, Department of Statistics and OR, Chapel Hill, NC, 27599, United States of America, nliu@email.unc.edu, Serhan Ziya

We model the appointment scheduling system as a single-server queue where new appointments join from the back of the queue. Motivated by empirical findings, we assume that patients do not show up for their appointments with probabilities that increase with their waiting time in queue before getting service. Under the objective of maximizing throughput, we study how optimal values of two design parameters, maximum size of the backlog queue and panel size, depend on patient no-show behavior.

■ WB58

H-Room 309, Third Floor

Scheduling for Computing and Service Systems

Cluster: Scheduling
Invited Session

Chair: Carri Chan, Stanford University, 260 King St. #545, San Francisco, CA, United States of America, cwchan@stanford.edu

1 - Pricing, Provisioning and Admission Control for Cloud Computing Services

Cathy Xia, Associate Professor, The Ohio State University, ISE, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Amit Gera, Robert Hampshire

In the emerging cloud computing services marketplace, both the cloud service provider operations decisions and the client adoption decision making process are facing new challenges. We propose an integrated framework for pricing, provisioning and client contract admission control while considering client preferences and the adoption decision.

2 - Cone Schedules for Processing Systems in Random Environments

George Michailidis, The University of Michigan, 1085 S. University, Ann Arbor, United States of America, gmichail@umich.edu

We consider a generalized processing system comprised of Q job classes. Further, the resources available for serving the customers are fluctuating over time due to reliability and availability variations. In this talk, we discuss this canonical resource allocation problem; specifically, we characterize the stability region of the system and introduce a class of policies, called Cone Schedules, that are shown to be throughput maximizing.

3 - Maximizing Throughput of Hospital Intensive Care Units with Patient Bounce-backs

Carri Chan, Stanford University, 260 King St. #545, San Francisco, CA, United States of America, cwchan@stanford.edu, Nick Bambos, Vivek Farias

When a patient arrives to a full Intensive Care Unit (ICU), a current patient may be prematurely discharged in order to accommodate him. This discharged patient may 'bounce-back' and impose an additional load on the already scarce ICU beds. We consider an index policy to select patients which must be prematurely discharge with the goal of minimizing the bounce-back load. The performance of this policy is guaranteed to be within a factor of 2 of optimal and likely to be close to 1-3% in practice.

4 - Scheduling over Networked Systems with Delayed State Information

Sachin Adlakha, Stanford University, Stanford, CA, United States of America, adlakha@stanford.edu, Sanjay Lall, Andrea Goldsmith

We consider scheduling over multiple servers, where the servers are connected to each other via delay lines. A centralized scheduler receives delayed state information from each server. We model this system as a Markov decision process over a graph. We derive sufficient information state required to make the optimal decision and show that it depends only on the graph structure and the associated delays.

■ WB59

H-Room 310, Third Floor

Tutorial: Open-Source Software

Cluster: Tutorials
Invited Session

Chair: Robin Lougee-Heimer, IBM Research, T.J. Waston Research Center, Yorktown Heights, NY, robinlh@us.ibm.com

1 - Open Source Overview for Operations Research Professionals
Robin Lougee-Heimer, IBM Research, robinlh@us.ibm.com

In our lifetime, the culture and software labeled as 'open source' has evolved from a niche activity to a mainstream movement. We introduce the key concepts, clarify the common misperceptions, and frame the significant developments of open source for operations research professionals in academia and business.

■ WB60

H-Room 311, Third Floor

Optimization Techniques

Contributed Session

Chair: David Papp, Rutgers University, 640 Bartholomew Rd, Center for Operations Research, Piscataway, 08854, United States of America, dpapp@rutcor.rutgers.edu

1 - Discrete Risk Optimization Models with p-Order Conic Constraints
Policarpio Soberanis, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, policarpio-soberanis@uiowa.edu, Pavlo Krokhmal

We present a class of risk-reward optimization models that reduce to integer programming problems with p-order conic constraints. As an illustration, a portfolio optimization application is considered. The proposed solution approach relies on the developed polyhedral approximations for p-order cones. Computational results of portfolio optimization case studies are discussed.

2 - Robust Regression Using Semi-definite Programming
Dzung Nguyen, UIUC, 205 North Mathews Ave., Urbana, IL, 61801, United States of America, ngtridung@yahoo.com

The robust regression problem is often formulated as the least trimmed squares (LTS) problem where we want to find the best subset of observations with the smallest sum of squared residuals. We show the LTS problem is equivalent to a concave minimization problem, which is very hard to solve. We resolve this difficulty by introducing the maximum trimmed squares problem that finds the worst subset of observations. This problem can be transformed into an SDP problem that can be solved efficiently.

3 - Shape-constrained Estimation of Multivariate Functions via Semidefinite Programming
David Papp, Rutgers University, 640 Bartholomew Rd, Center for Operations Research, Piscataway, 08854, United States of America, dpapp@rutcor.rutgers.edu, Farid Alizadeh

Function estimation problems often involve functions that must satisfy certain shape constraints, which usually reduce to the nonnegativity of linear functionals of the estimated function. If the estimator is a multivariate spline, then these constraints are intractable; hence we consider tractable restrictions involving weighted-sum-of-squares cones. We present theoretical justifications of the proposed method, applications, and computational results.

■ WB61

H-Room 312, Third Floor

Emergency System Design

Contributed Session

Chair: William Degnan, Florida Atlantic University, 777 Glades Road, Boca Raton, FL, 33431, billydegnan@gmail.com

1 - A Decision Model for Resource Allocation under Uncertainty for Infectious Animal Disease Outbreaks
Sarah Riddell Powers, LLNL, 7000 East Avenue, L-153, Livermore, CA, 94550, United States of America, sriddell@llnl.gov

In the event of an animal disease outbreak, current response strategies do not account for a limitation of available resources. Using simulated outbreak data, a decision framework is established which presents optimal policies for allocating scarce resources while minimizing the spread and impact of the outbreak. We discuss the application of game-theoretic concepts to this problem.

2 - Assessing and Managing Urban Fire Risk Utilizing a Coupled Model of Water and Fire Infrastructures
Kelly Brumbelow, Assistant Professor, Texas A&M University, WERC Building, Room 205L, 3136 TAMU, College Station, TX, 77843-3136, United States of America, kbrumbelow@civil.tamu.edu, Lufthansa Kanta

An urban fire risk assessment methodology is developed by introducing fire hazard probabilities and by incorporating actual WDS failure scenarios. A coupled model of water and fire response infrastructure is utilized to evaluate the fire consequences in terms of building specific data such as number of people displaced and cost of property damage.

3 - Commodity Flow and Vehicle Routing in Natural Disasters
Abbas Mohasel Afshar, Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College park, MD, 20742, United States of America, afshar@umd.edu, Masoud Hamedi, Ali Haghani

A mathematical model at the operational level is proposed that can be used in the critical hours and days immediately after a disaster strikes. The model is a large scale multicommodity multimodal network flow structure that considers details of vehicle routing/scheduling and flow of relief items from several sources to the hands of recipients. Numerical analysis for a hypothetical case study similar to hurricane Katrina shows promising results.

4 - A Hybrid Simulation Model for Preparedness and Response in Urban Areas under Bioterrorist Attack
William Degnan, Florida Atlantic University, 777 Glades Road, Boca Raton, FL, 33431, billydegnan@gmail.com, Evangelos Kaisar, Alexandra Johnson

Due to the recent nature of terrorist attacks, weapons of mass destruction and biological weapons, the need for planning and preparedness has dramatically increased. In the event of an attack requiring emergency response, transportation capabilities become extremely critical. This paper will explore the effects on access to treatment centers due to a bioterrorist smallpox attack on an urban city. Optimization is completed using a hybrid simulation model technique implementing micro and mesoscopic levels simultaneously.

■ WB62

H-Room 313, Third Floor

Career Issues in Organizations

Contributed Session

Chair: Gregory Dawson, Assistant Professor, Arizona State University, W. P. Carey School of Business, 4701 W. Thunderbird Road, Glendale, AZ, 85306-4908, United States of America, gregory.dawson@asu.edu

1 - The Influence of Hierarchical Level on the Professional and Managerial Orientation of Professionals
Desdemona Hucke, Research Assistant, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, hucke@wiso.uni-koeln.de, Ludwig Kuntz

We examine the influence of hierarchical level of professionals on their managerial and professional orientation from two theoretical perspectives empirically (180 physicians, 3 German hospitals). First, we investigate the "deprofessionalization" and second, the "collaborative" perspective. Our results lend support to the "collaborative" perspective. We show that hierarchical career enhances managerial orientation and values without diminishing the values of the liberal professions.

2 - Career Mobility and Success in a Professional Specific Labor Market
Christiane Zobel, Research Assistant, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, zobel@wiso.uni-koeln.de, Ludwig Kuntz

Professionals are embedded in an occupational specific career system, which permits inter- and intraorganizational mobility to reach top positions. As shown in previous studies career mobility primarily occurs according to up-or-out promotional systems. By analyzing event history data (324 physicians, 700 hospitals) we find a positive effect of interorganizational mobility and duration in complex organizations on career success. This provides indication of an out-and-up promotional system.

3 - Employee Satisfaction Model for Insurance Companies
Baris Carikci, TUSSIDE- TUBITAK, Gebze/Kocaeli, Kocaeli, Turkey, bcarikci@yahoo.com

The importance of employee satisfaction is well understood in many organizations. The factors behind employee satisfaction, however, are unique for each sector. A detailed research is done to extract factors that exist in an insurance company of which sector is highly challenged by the high turnover rates. The findings are especially beneficial for the insurance companies that aim at healthy human resources.

4 - Career is Over? An Analysis of Survivability of C-Suite Executives in the Public and Private Sector

Gregory Dawson, Assistant Professor, Arizona State University, W. P. Carey School of Business, 4701 W. Thunderbird Road, Glendale, AZ, 85306-4908, United States of America, gregory.dawson@asu.edu, Robert Kauffman

Much ado has been made about the short tenure of chief information officers (CIOs) To date, no empirical studies have examined the tenure of CIOs relative to other C-suite executives. Drawing on cross-disciplinary theories of executive career paths, we model CIO survival using duration modeling methods. Our analysis examines public and private sector executive tenure data and permits us to draw conclusions on how CIO tenure compares to other C-Suite executives.

■ WB63

H-Room 314, Third Floor

Health Care Strategy I

Contributed Session

Chair: Monali Malvankar, PhD Candidate, Ivey School of Business, University of Western Ontario, 1151 Richmond St North, London, ON, N6A3K7, Canada, mmalvankar@ivey.uwo.ca

1 - Analyzing the Effects of Contracts in Health Care Systems

Brandon Pope, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, brandon_pope@tamu.edu, Andy Johnson, Abhijit Deshmukh

We analyze contracts between insurance companies and health care providers. Contracting allows decision makers to achieve Pareto improvements in situations of strategic interdependence. Depending on the structure of the interdependence, different types of contracts may be preferred. We consider various relationships which providers have with insurers in order to construct optimal contracts for health care systems.

2 - Coordinating Contracts in a Preventive Health-care System

Reza Yaesoubi, PhD Candidate, North Carolina State University, Campus Box 7906, 421 Daniels Hall, Raleigh, NC, 27511, United States of America, ryaesou@ncsu.edu, Stephen Roberts

We consider a health care system consisting of two noncooperative parties: a health purchaser and a health provider. The health provider determines the type of patients who should undergo a preventive medical intervention, and the health purchaser reimburses the health provider based on the number of patients who have used the intervention. We determine the contracts that coordinate this system; i.e., the contracts that lead to Nash equilibrium while maximizing the population's welfare.

3 - A Simulation Model for Liver Transplantation

Monali Malvankar, PhD Candidate, Ivey School of Business, University of Western Ontario, 1151 Richmond St N, London, ON, N6A3K7, Canada, mmalvankar@ivey.ca, Greg Zaric, David Stanford

The liver transplantation wait list in London, Ontario, serves a wider region including parts of Northern Ontario, and shares responsibility for Manitoba. We present a simulation model for operation of the wait list, and use it to investigate the delay impact of factors such as blood type and various patient selection rules.

■ WB64

H-Room 202A, Second Floor

Industry Applications

Contributed Session

Chair: Marta Freitas, Associate Professor, Federal University of Minas Gerais (Universidade Federal de Minas Gerais), Depto. de Eng. de Produàñao Pavilhao, Belo Horizonte, 30161970, Brazil, marta@dep.ufmg.br

1 - Binning and Allocation Strategies for Satisfying Semiconductor Customer Demand

Brittany Bogle, Undergraduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bmbogle@uark.edu, Scott Mason

Binning, the post-production sorting of electronic devices based on device functionality, places devices into different functional bins (e.g., high functionality bin, medium functionality bin, etc.). Items in each bin can be used to satisfy demand for the same or lower product functionality levels (i.e., medium bins can satisfy medium or low functionality orders, not high). We investigate minimizing production and inventory costs while satisfying demand based on real world case study data.

2 - Strategic Forecasting: Case Studies of Collaborative Modeling and Simulation

Brian Lewis, VP Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

The knowledge a company needs to develop strategic forecasts is divided among individuals spread throughout the organization. Collaborative Modeling and Simulation frees decision-makers from having to rely on the analysis of a single planner by directly involving key individuals in the modeling process. We present three case studies: 1) Forecasting manufacturing costs to improve product design; 2) Market forecast simulations of product portfolios; 3) Supply chain models for capacity planning.

3 - A Closer Look at the Problem of Shelf Life Determination Using Multiple Sensory Evaluation Scores

Marta Freitas, Associate Professor, Federal University of Minas Gerais (Universidade Federal de Minas Gerais), Depto. de Eng. de Produàno Pavilhno, Belo Horizonte, 30161970, Brazil, marta@dep.ufmg.br, Fernanda Dias

In this article we present a model for shelf life determination of food products, using sensory evaluation scores. The data is dichotomized and the underlying failure times of two attributes are jointly modeled by a bivariate Weibull distribution. The approach is applied to a real data set.

■ WB65

H-Room 202B, Second Floor

Multi-Echelon Inventory Management

Contributed Session

Chair: Xu Yang, University of Louisville, Department of Industrial Engineering, Louisville, United States of America, x0yang07@louisville.edu

1 - Customer Service in a Two-level Periodic Review Inventory Model with Poisson Demand

Arda Yenipazarli, University of Florida, University of Florida Warrington College, of Business Administration, Gainesville, FL, 32611, United States of America, ayenipazarli@ufl.edu, Paul A. Anand

This paper deals with the problem of minimizing the base-stock inventory of a one-warehouse M-identical retailer inventory system, in which central depot uses a periodic review, order-up-to inventory policy and retailers face stochastic customer demand, and develops an exact formula for the fill-rate constraint of each retailer.

2 - Heuristics for Multi-item, Two-echelon Inventory System with Aggregate Mean Wait Time Constraint

Arjun Subramaniam, Materials Project Manager, Applied Materials, 2821 Scott Blvd, Santa Clara, CA, 95050, United States of America, arjun.subramaniam@gmail.com, Deepak Bhatia

We consider a multi-item, two-echelon spare parts inventory system, with one central warehouse and multiple local warehouses. We present close-to-optimal, scalable heuristics to minimize total cost with each local warehouse subject to an aggregate mean wait time constraint. All locations operate under a continuous review system with base stock policies. We test effectiveness by comparing with the lower bound and results from recently published work and demonstrate better performance.

3 - Analysis of a Serial Inventory System with Ordering Costs

Ayse Gonul Karaarslan, PhD Student, Eindhoven University of Technology, Department of Technology Management, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, a.g.karaarslan@tue.nl, Gudrun Kiesmuller, Ton de Kok

We analyze a serial multi-echelon inventory system under periodic echelon base stock policy. Stockpoints have nested reorder intervals and each stockpoint incur a fixed ordering cost whenever its inventory is replenished. We give exact formulas for system-wide average expected cost and derive necessary conditions for optimal base stock levels. We also construct a heuristic to find near optimal policy parameters.

4 - Real-time Optimization in a Multi-echelon, Multi-product, Multi-carrier, Multi-period System

Xu Yang, University of Louisville, Department of Industrial Engineering, Louisville, United States of America, x0yang07@louisville.edu, Sunderesh Heragu, Gerald Evans

An integrated optimization model of production, inventory and distribution is proposed to coordinate important and interrelated decisions. The model is solved by a modified Benders decomposition algorithm. An agent-based simulation model is also proposed to assist decision makers adjusting from the optimal solutions given by the optimization model. It supports more flexible and comprehensive modeling capabilities which are difficult to realize in a general optimization model.

■ WB66

H-Room 204A, Second Floor

Integrating Performance Management of Operational Risk in Core Planning Processes: Recent Activity at Leading Companies

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Blake Johnson, Consulting Professor, Stanford University, 12881 Via Grimaldi, Del Mar, CA, 92014, United States of America, blakej@stanford.edu

1 - Using Range Performance to Incorporate Supply and Demand Uncertainty in Core Planning Processes

Blake Johnson, Consulting professor, Stanford University, 12881 Via Grimaldi, Del Mar, CA, 92014, United States of America, blakej@stanford.edu

The current planning processes of nearly all companies fail to incorporate uncertainty. Because operational planning provides the foundation of management, uncertainty cannot be systematically incorporated in key activities from resource allocation to operating policies and performance metrics. Range performance provides the necessary bridge between operations and core planning and management processes by quantifying the impact of supply and demand uncertainty on future operational performance.

2 - Sometimes Engineering is Not Enough

Dario Benavides, Strategy and Decision Support Manager, Google, 1600 Amphitheatre Parkway, Mountain View, CA, 94043, United States of America, dario@google.com

Operations at Google represents all the infrastructure and people needed to power the company's products. This mean: datacenters, servers, network and the people to design and fix this infrastructure. Engineering design decisions can have a large impact in Capex and Opex. To optimally make those decisions we used the total cost of ownership of each alternative. During this talk we will present a quick intro to operations at Google and an example of one of these engineering decisions.

3 - Communicating Supply Chain Insights to Non Supply Chain Stakeholders

Apiruk Detwarasiti, Manager, Strategic Planning and Modeling, Hewlett-Packard, 138 Depot Road, Singapore, Singapore, apiruk.detwarasiti@hp.com

As an internal consulting group within Hewlett-Packard, the Strategic Planning and Modeling (SPaM) team has done many projects that were initiated by supply chain but had tremendous impact on non supply chain organizations. Our approach is to collaboratively involve non supply chain stakeholders early on in the project. We found that focusing on key insights in an easy-to-interpret manner is more critical than comprehensiveness when presenting to cross-functional teams of stakeholders.

4 - Managing Your Corporate Innovation Portfolio Manager

Scott Mathews, The Boeing Company, Seattle, WA, United States of America, scott.h.mathews@boeing.com

The Boeing Ideas to Innovation (I2I) process couples a social networking ideation event tool together with an idea portfolio management tool to mature and select the very best strategic opportunities. The presentation provides an insight on how corporations can implement and manage their innovation pipelines. But wait theres more — weaning managers away from a traditional project management mindset by providing them with new innovation portfolio management concepts using real option thinking.

■ WB67

H-Room 204B, Second Floor

Robust and Adaptive Optimization

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Vineet Goyal, Postdoctoral Associate, MIT, 77 Massachusetts Ave, E40-111, Cambridge, MA, 02139, United States of America, goyalv@MIT.EDU

1 - Performance Analysis of Queueing Networks via Robust Optimizaiton

Alexander Rikun, MIT, 1 Amherst St. E40-149, Cambridge, MA, 02139, United States of America, arikun@mit.edu, David Gamarnik, Dimitris Bertsimas

In this paper we propose a new approach for performance analysis of queueing networks based on robust optimization. We apply our approach to tandem single class and multiclass single server queueing networks. In both cases we obtain explicit bounds on performance measures such as sojourn time and busy period. We extend these results to compute similar bounds on the underlying stochastic queueing model.

2 - On the Relative Power of Robust and Two-stage Stochastic Optimization

Vineet Goyal, Postdoctoral Associate, MIT, 77 Massachusetts Ave, E40-111, Cambridge, MA, 02139, United States of America, goyalv@MIT.EDU, Dimitris Bertsimas

We show that, under fairly general assumptions on the model and the uncertainty, an optimal (fixed) solution to a two-stage mixed integer robust optimization problem (that can be computed efficiently), is a good approximation for the two-stage stochastic optimization problem which is a computationally intractable problem in general. We also extend these results for the two-stage adaptive optimization problem which is similar to stochastic optimization in computational complexity.

3 - Likelihood Robust Optimizations and its Applications

Zizhuo Wang, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, zzwang@stanford.edu, Yinyu Ye, Peter Glynn

We study a new type of robust optimization which we call the likelihood robust optimization and apply it to several classical problems. In contrast to the previous works that studied the robustness with respect to mean or variances, we consider the distributions that make the observed data achieve a certain level of likelihood. We show that this distribution set has very interesting and rich statistical meanings. We also show this approach exhibits better performances for some practical problems.

4 - The Price of Fairness

Nikolaos Trichakis, Doctoral Student, MIT, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States of America, nitric@mit.edu, Dimitris Bertsimas, Vivek Farias

We study resource allocation problems that involve multiple self- interested parties and a central decision maker. We introduce and study the price of 'fairness', which is the relative welfare reduction under a fair allocation. We focus on two well accepted, axiomatically justified notions of fairness and for these notions identify a broad family of problems where the price of fairness is low. We provide tight performance guarantees, backed by illustrative examples.

■ WB68

H-Room 206, Second Floor

Chance-constrained Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, School of Industrial & Systems Engineeri, 765 Ferst Drive, Atlanta, GA, 30332, sahmed@isye.gatech.edu

1 - Heuristics for Chance-constrained Stochastic Programs

Feng Qiu, ISyE, Georgia Tech, 350516 GeorgiaTech Station, Atlanta, GA, United States of America, fqiu@gatech.edu, Shabbir Ahmed

We propose heuristic methods for solving linear programs with k-out-of-m constraints. These problems arise in sample average approximations of chance constrained stochastic programs. The heuristics are based on exploiting star convexity structure of the problem and variable fixing in an integer programming formulation of the problem.

2 - Construction of Index Funds under a Risk Averse Constraint

Miguel Lejeune, Assistant Professor, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu, Gulay Samatli-Pac

We construct index funds under the constraint that the risk exposure is below a threshold level. The fund includes a limited number of assets (cardinality constraint) and is intended to consistently reproduce the return of a market index. The risk of the fund is represented by a factor model and the risk tolerance is modeled using a probabilistic constraint. An outer approximation method is proposed to solve the corresponding probabilistic integer problem. Numerical results are presented.

3 - Expectation and Chance-constrained Models and Algorithms for Insuring Critical Paths

Siqian (May) Shen, PhD Student, Department of ISE, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sshen@ufl.edu, Shabbir Ahmed, Cole Smith

We consider a class of two-stage stochastic optimization problems arising in the protection of vital arcs in a critical path network, in which task finishing times are uncertain, but can be insured a priori to mitigate potential delays. We consider a chance-constrained version, and employ RLT to remodel the problem to be amenable to solution via Benders decomposition. We employ SAA and demonstrate how to obtain feasible solutions and optimality bounds for this problem.

■ WB69

H-Indigo A, Second Floor

Social Networks and Peer Effects Session

Sponsor: Marketing Science
Sponsored Session

Chair: Li Chen, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, United States of America, lchen@business.uconn.edu

1 - On Peer Effects in Clinical Information Technology Adoption
Haijing Hao, PhD Student, Heinz College, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, haohaijing@cmu.edu, Rahul Telang, Rema Padman

We examine the impact of peer effects on adoption of mobile clinical applications by providers in a community health system. Panel usage data by 250 solo and group practice physicians over 22 months were analyzed using several models. Preliminary results indicate peer effects exist and are impacted by multiple factors.

2 - Exploring the Relationship Between Sponsor's Evaluation and Member's Continued Contribution in Online
Li Chen, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, United States of America, lchen@business.uconn.edu, James Marsden, John Zhang, Paulo Goes

In "brainstorm" communities, "Web 2.0" tools allow companies to seek potentially valuable input from the community members. However, we know little about the effect of sponsoring company's feedback on members' behavior. Using data over the first two years of Dell IdeaStorm, we find that (1) feedbacks from both the sponsors and other members are significant factors for continuing participation; (2) negative feedbacks appear to have the same positive effect as positive ones.

■ WB70

H-Indigo B, Second Floor

Supply Chain Facility Design

Contributed Session

Chair: Bernhard Fleischmann, Professor, University of Augsburg, Universitaetsstrasse 16, Augsburg, D-86315, Germany, bernhard.fleischmann@wiwi.uni-augsburg.de

1 - A Profit Maximization Model For Constructing Global Supply Chains
Tan Miller, Harper Professor and Director of the Global Supply Chain Program, Rider University, 12 Winding Way, Morris Plains, NJ, 07950, United States of America, tanjean@verizon.net, Renato De Matta

We propose a profit maximization model for a firm establishing or rationalizing a multi-national supply chain to produce and deliver finished goods from sources to consumers. The methodology simultaneously evaluates the impact of intra-firm transfer pricing, global exchange rates and traditional location factors in the supply chain network design problem.

2 - Heuristic Solutions for Biomass-to-biofuel Supply Chain Design and Management
Ambarish Acharya, PhD Student, Mississippi State University, P O Box 9542, Dept of Ind & Sys Engg, McCain Hall, Mississippi State, MS, 39762, United States of America, ama206@msstate.edu, Sandra Eksioglu

In this research we consider Biomass-to-Biofuels supply chain design and management problem. The problem is formulated as a multi-commodity network flow problem. This model captures properties of biomass such as deterioration and seasonality. The problem is NP-Hard. Therefore, a Lagrangean relaxation is designed to find lower bounds, and a heuristic is developed to find upper bounds for this problem.

3 - Inventory and Number of Warehouses: An Old Story Revised
Bernhard Fleischmann, Professor, University of Augsburg, Universitaetsstrasse 16, Augsburg, D-86315, Germany, bernhard.fleischmann@wiwi.uni-augsburg.de

Most inventory-location models assume a square-root function between the demand served by a warehouse and both its safety stock and its cycle stock. However, for a fixed fill rate, the safety factor is not constant, but depends on the demand and the order size. The latter is in reality not an EOQ, but restricted by the vehicle capacity and a minimum frequency of shipments. We propose a model based on these relationships and show the resulting inventory functions for realistic data settings.

■ WB71

H-Indigo C, Second Floor

Supply Chain Optimization

Contributed Session

Chair: Ismail Capar, Texas A&M University, 3367 TAMU, College Station, TX, 77840, United States of America, Capar@entc.tamu.edu

1 - An Optimization Model for Reducing Coordination Costs in a Supply Base
Seong Hyun Nam, Associate Professor, University of North Dakota, Management Department, College of Business & Public Administrat, Grand Forks, ND, 58202, United States of America, seong_nam@und.edu

This paper introduces an optimizing model to minimize the impact of demand uncertainty in the supply base. It focuses on developing an analytical model to determine the optimal level of coordination policy for a firm that purchases components from external suppliers. Four variables will be considered in this study: 1) demand uncertainty, 2) number of suppliers, 3) duration of the contracts, and 4) coordination costs of dealing with supply uncertainty as well as demand uncertainty.

2 - Using Shapley Value to Divide Profits under Supply Chain Contracts
Lihua Chen, Teaching Fellow, Kent State University, Department of M&IS, P.O. Box 5190, Kent, OH, 44240, United States of America, lchen8@kent.edu, Marvin Troutt

We consider one supplier and two competing retailers who face the Newsvendor problem over one selling period. The Shapley value concept from cooperative game theory is applied to coordinate a supply chain and split the total profits among all the parties. Parameters are determined to reach a core profit allocation scheme with a couple of pervasive supply chain contracts.

3 - Coalition Stability in Joint Replenishment Systems
Adel El Omri, Ecole Centrale Paris, Grande voie des Vignes, Chatenay-Malabry, 92290, France, adel.omri@ecp.fr, Asma Gaffari, Zied Jemai, Yves Dallery

We consider joint replenishment games with general cost function where retailers belong to different firms. We show that research aiming on finding the systemwide optimal policies are not viable. We propose a new formulation of the coalition generation problem that gives priority to the profit of separate alliances over the profit of the total system. The proposed method is showed to guarantee the stability of the coalitions and to provide a strong incentive for the retailers to cooperate.

4 - Dynamically Adjusted Shipment Consolidation Decisions in a Two-stage Supply Chain
Ismail Capar, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, capar@tamu.edu

Many researchers have focused on tractable algorithms to prove the optimality of joint shipment consolidation and inventory decisions. One of the key assumptions of tractable algorithms is to assume negligible lead time from an outside supplier. We relax the instant replenishment assumption and provide a decision rule for a decision maker whose objective is to minimize the total supply chain cost. We perform a numerical analysis using simulation to measure the performance of the decision rule.

■ WB72

H-Indigo D, Second Floor

Novel Applications

Contributed Session

Chair: Nurcin Celik, PhD Candidate, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85719, United States of America, nurcinkoyuncu@gmail.com

1 - A Study of a Practical Piano Fingering
Keisuke Hotta, Bunkyo University, 1100 Namegaya, Chigasaki, Kanagawa, 2538550, Japan, khotta@shonan.bunkyo.ac.jp

There are some research of piano fingering. But they cannot be widely applied by strong constraints, so they are not useful for piano performance. The purpose of this research is to seek a practical piano fingering using mathematical technique.

2 - Approximation Methods in Modeling the Detection Capability of Underwater Sensors

Staci Wasserman, Engineer, Naval Undersea Warfare Center, 1176 Howell Street, Newport, RI, 02841, United States of America, staci.wassermann@navy.mil

Our current work involves modeling and optimizing performance of sets of underwater distributed sensors. Various factors affect the directional sensing capability of an underwater sensor. Since incorporating this directionality complicates the problem, we currently approximate the detection area with an averaged radius (of a circle around the sensor) of detection. I am investigating approximation methods and the resulting trade off between improving accuracy and increasing complexity.

3 - Optimization Techniques for Inverting Fundamental Equations in Neuroscience

Dylan Shepardson, Georgia Tech, 475 Woodward Ave, Atlanta, GA, 30312, United States of America, dylan.shepardson@gatech.edu

Since the 1950's, when Hodgkin and Huxley developed a system of equations describing the electrical activity of the squid giant axon, neuroscientists have been equipped with a powerful theoretical framework for understanding neuronal function. These equations take as input data representing the internal state of the neuron and simulate the behavior of the neuron. I will present an iterative, optimization-based algorithm for solving an inverse problem associated with these differential equations.

4 - An Integrated Simulation Modeling Framework for Enterprise Software Development Process

Nurcin Celik, PhD Candidate, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85719, United States of America, nurcinkoyuncu@gmail.com, Young-Jun Son, Seungho Lee, Esfandyar Mazhari

A novel simulation modeling framework is proposed to allow the stakeholders of enterprise software development to perform what-if analyses for their decisions. The framework involves mimicking individual human decisions, their interactions with conflicting goals in a social network, and estimating software development process with respect to time, complexity, cost and quality. The proposed framework is illustrated with a case study in Kuali, an open source project involving nine universities.

■ WB73

H-Indigo E, Second Floor

Analysis of Queueing Models II

Contributed Session

Chair: Alan Krinik, California State Polytechnic University, Pomona, CA, United States of America, ackrinik@csupomona.edu

1 - Batching Policies in Semi-process Industries

Ananth Krishnamurthy, Dept of ISyE, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, akrishn2@wisc.edu

Batch operations impose significant constraints in production operations of semi-process industries. This research first compares the batching issues in these industries against those observed in classical discrete product manufacturing and subsequently uses analytical queuing models to provide insights into the performance tradeoffs of different batching policies.

2 - Queueing Systems with Pre-scheduled Random Arrivals (PSRA)

Gianluca Guadagni, University of Virginia, Department of Mathematics, Charlottesville, VA, United States of America, guadagni@virginia.edu, Sokol Ndreca, Benedetto Scoppola

We study a model of air traffic where clients arrive randomly about their scheduled time. This process is asymptotically Poisson but, at any scale, it is not Poisson, with correlations and finite congestion patterns. With cancellations and pop-ups it is a superposition of a fast process and a slow, birth and death, one. The Ground Delay Program (GDP) is a disruption of the slow process. We can evaluate the time to return to stationarity, and the expected number of lost slots during GDP.

3 - Approximations for Departure Processes When Time-phased Releases are Set for M/M/1 Queues in Series

Diederik Claerhout, Lessius University College, Korte Nieuwstraat 33, Antwerp, 2000, Belgium, Diederik.Claerhout@lessius.eu, Nico Vandaele

A key characteristic of MRP systems includes the coordination of assembly and purchased component requirements by time-phased order releases. These latter are also described in the workload control literature as worthy alternatives to load limited releases. Based on the stationary-interval method and the asymptotic method, we present approximating renewal processes for the departure processes which are important to quantify the impact of time-phased release mechanisms on M/M/1 queues in series.

4 - Simulating a Government Contract Closeout Process

Joe Wilck, Assistant Professor, The University of Tennessee (Knoxville), 411 East Stadium Hall, Knoxville, TN, United States of America, joe.wilck@gmail.com, Clayton Capizzi

To maintain good relations with organizations regulating government contracts, contractors are forced to devise a strategy for contract closeouts. Through utilization of business process modeling, an organization is able to not only model the flow of their closeout process, but simulate the performance of their process under varying conditions so that deadlines are met. The simulation produced a model which allows an organization to allocate resources to complete the contract closeout process.

5 - The M/M/1 Single Server Queueing System Generalized to Include Transitions Steps of Size Two

Mohammad Kassab, California State Polytechnic University, Pomona, CA, United States of America, Alan Krinik, Ken Shun

The steady state behavior of Markov processes having constant transition rates of step size one and two as shown in the following diagram are analyzed when fl, lambda, gamma, $\mu > 0$. Explicit general formulae (and conditions) for the steady state distributions of Markov processes of this type (finite and countably infinite state space cases) are developed. Interpreting these processes as a model for a single server queuing system (generalizing the classical M/M/1 system); queueing performance measures for the average number of customers in the system and queue (as well as the average waiting time in the system and queue) are presented. Steady state distributions and performance measures for a variety of these processes are tabulated and compared. Results for related gambler's ruin type probabilities will be included as time permits.

■ WB74

H-Indigo H, Second Floor

Reliability

Contributed Session

Chair: Sowmya Parimi, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968-0521, United States of America, sparimi@miners.utep.edu

1 - Optimal Inspection Interval for a System Under Two Types of Failure

Sharareh Taghipour, Student, University of Toronto, 1210-450 Walmer Road, Toronto, ON, M5P 2X8, Canada, sharareh@mie.utoronto.ca, Dragan Banjevic, Andrew K.S. Jardine

An inspection model for a repairable system subject to "operational failures" and "defects" is presented. As soon as an operational failure occurs the system is sent for repair. However, defects are rectified at either pre-scheduled inspection times or non-scheduled inspection times arisen due to an operational failure.

2 - Component Replacement Schedules for Power Distribution Systems Using Evolutionary Algorithms

Vasukumar Chenna, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968-0521, United States of America, franciscoespiritu@yahoo.com, Jose Espiritu

We present a new model to obtain optimal replacement policies for power distribution systems over a finite time horizon subject to budget constraints. The algorithm considers two decisions to be made at the beginning of each time which are to either keep the component in the system for one more period or replace it with a new one. An ant colony optimization model is developed and is applied to a radial configuration which is commonly used by the power industry

3 - Estimation of CBM Model Parameters Using Vibration Data

Ming Yang, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, yangming@mie.utoronto.ca, Viliam Makis

Vibration monitoring of a deteriorating gearbox can be modeled as a three state hidden Markov model with partial information. Optimal maintenance policies have been studied for such models assuming that the model parameters are known. In this paper, we present a method for the estimation of the model parameters using vibration data. The pseudo likelihood function is maximized and the EM algorithm is applied. Numerical results using real gearbox vibration data are obtained.

4 - Solving Component Allocation Problems in Electricity Distribution Systems via Genetic Algorithms

Sowmya Parimi, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968-0521, United States of America, sparimi@miners.utep.edu, Jose Espiritu

A new genetic algorithm is developed to solve component allocation problems for electricity distribution systems. The main objective is to obtain an optimal allocation of components to build an electricity distribution system which

minimizes the total expected system downtime subject to cost and repair time constraints. The algorithm developed is applied to the Dual Element Spot Network configuration which is one of the most commonly used configurations by the power industry.

Wednesday, 12:45pm - 2:15pm

■ WC01

C-Room 21, Upper Level

Joint Session DA/ENRE: Expert Elicitations and Analysis on Energy Technology

Sponsor: Decision Analysis & Energy, Natural Res & the Environment/Forestry
Sponsored Session

Chair: Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu

1 - Expert Elicitation of Cost, Performance, and RD&D Budgets for GHG Reducing Technologies

Melissa Chan, Harvard Kennedy School, 79 John F. Kennedy Street, Box 134, Cambridge, MA, 02138, United States of America, Melissa_Chan@ksg.harvard.edu, Laura Diaz Anadon

Our goal is to determine the performance and cost change that can be achieved by a focused research, development and demonstration (RD&D) program. We ask experts for their business-as-usual estimate of technology performance and cost in 2015 and 2025, and their opinion of how this will change with an enhanced RD&D program and budget. We will discuss our method and preliminary survey results, selection of industries and technologies, and evaluation of the current state of the technologies.

2 - Assessing the Future Potential of Renewable Energy Technologies

Max Henrion, CEO, Lumina Decision Systems, Inc, 26010 Highland Way, Los Gatos, CA, 95033, United States of America, henrion@lumina.com, James McVeigh, Sam Baldwin, Thomas Jenkin

The US Department of Energy funds R&D for a wide range energy efficiency and renewable energy technologies. To assist the evaluation and management of this project portfolio, we conducted expert elicitations on the effect of R&D funding on the future performance of over forty new technologies. We describe the elicitation process and present initial results.

3 - Expert Elicitations on Energy Technologies for Climate Change Policy

Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Jeff Keisler

We performed expert elicitations on energy technologies including solar, nuclear, carbon capture, and batteries for vehicles. We discuss the results of the elicitations, and present resulting random Marginal Abatement Cost Curves for different R&D funding levels.

4 - Geoengineering: Costs, Benefits, Risks

J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

The Earth is warming more quickly than many scientists feared. Despite nearly two decades of international negotiation, CO2 emissions grew more quickly in the last eight years than they did during the 1990s. Even driving emissions immediately to zero still brings the prospect of 1-2 degrees C of warming. Given these realities, should we take a more proactive role in managing the earth's climate? In this talk, we will discuss the costs, benefits, and potential risks of geoengineering.

■ WC02

C-Room 22, Upper Level

Preferences Over Intertemporal Outcomes

Sponsor: Decision Analysis
Sponsored Session

Chair: Jay Simon, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, Monterey, CA, 93940, United States of America, jrsimon@nps.edu

1 - Consistency Among Two Elicitation Procedures for Intertempotal Choice

Jeffery Guyse, Associate Professor, California State Polytechnic University, College of Business Administration, 3801 W. Temple Ave, Pomona, CA, 91768, United States of America, JLGuyse@csupomona.edu, Jay Simon

The within subject consistency between two popular elicitation procedures for intertemporal choice (valuation of sequences and pairwise matching) is investigated. In addition, the three prevalent anomalies that have surfaced in the pairwise matching task research (magnitude effect, short/long asymmetry, and gain/loss asymmetry) are explored in the relative evaluation of sequences tasks.

2 - Time Inconsistency of Risk Perception

Yitong Wang, University of California, Irvine, The Paul Merage School of Business, Irvine, CA, 92617, United States of America, ywang07@exchange.uci.edu, L. Robin Keller, Tianjun Feng

Time inconsistency of preference has been well documented in the literature. In this paper we investigate intertemporal changes of risk perceptions in decisions under uncertainty. We propose that temporal distance has different influence on different attributes of decisions (e.g., loss and probability of loss in a gamble) with respect to risk perceptions. We further conduct experiments to examine the proposition and provide a detailed discussion of our results.

3 - The Timing and Deterrence of Terrorist Attacks

Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Kjell Hausken

In this paper, we develop a model for the timing and deterrence of terrorist attacks. The defender moves first and the attacker second in a two stage game which is repeated over T periods. We study the effects of dynamics of several critical components of counter-terrorism games, including the unit defense costs, unit attack costs, and the asset valuation. We study deterministic dynamics and conduct simulations using random dynamics.

4 - Reference-dependent Expected Utility: Possibilities and Challenges

Jay Simon, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, Monterey, CA, 93940, United States of America, jrsimon@nps.edu, L. Robin Keller

Reference-dependent utility has become a popular method for modeling intertemporal preferences. While it does confer advantages as a descriptive model, one significant challenge is that it can make expected utility very difficult to compute a priori, which limits its prescriptive applicability. In this work, we discuss specific utility formulations that can circumvent this issue, and we analyze general properties that will lead to tractability in reference-dependent expected utility modeling.

■ WC03

C-Room 23A, Upper Level

Mitigation Strategies for Supply Chain Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Sanjay Kumar, Penn State Erie, 5101 Jordan Rd., Erie, PA, 16563, United States of America, sxk89@psu.edu

1 - An Extensible Agent-based Simulation and Modeling Framework for Supply-chain Risk Analysis

Shenghan Xu, Assistant Professor, University of Idaho, College of Business and Economics, P.O. Box 443161, Moscow, ID, 83844, United States of America, shenghan@uidaho.edu, Li Tan

This research proposes an agent-based framework for simulating and analyzing stochastic supply chains. The agent-based framework enables us to study risks arising from interactions among elements in a large-scale supply chain. It allows an analyst to define new types of supply-chain elements based on targeted applications. An analyst can define the semantics of supply-chain elements by defining his own supply-chain strategies. We implement the framework in a Java-based tool SimRisk.

2 - The Vulnerability of a Supply System with Facility Recovery Time: Analysis and Improvement

Chaya Losada, PhD Candidate, Kent Business School, University of Kent, Canterbury, CT2 7PE, United Kingdom, cl243@kent.ac.uk, Paola Scaparra, Richard Church

In the context of critical infrastructures, interdiction models are commonly used to identify the worst scenario due to a disruption. Recent interdiction models capture complex issues such as probabilistic aspects and system capacities. Here, we propose an interdiction-protection model that considers a new dimension, i.e., time. Namely, we analyse and improve the vulnerability of a supply system by considering a planning horizon.

3 - You Get What You Pay For: How to Make Suppliers Avoid Product Recalls

Ana Groznik, Assistant Professor, Universidade Catolica Portuguesa, Palma de Cima, 1649-023 Lisboa, Lisboa, Portugal, agroznik@fcee.lisboa.ucp.pt, Hans Sebastian Heese

A general belief links the cost pressure on suppliers to the increasing frequency of product recalls. We model a supply chain where the supplier decides on costly effort, which affects the probability of a recall, but is not directly observable to the manufacturer and thus not contractible. We compare the effects of wholesale price increases and long-term contractual commitment on a supplier's incentives to exert effort and thus decrease the likelihood of product recalls.

■ WC04

C-Room 23B, Upper Level

Data Mining for Prediction Problems

Sponsor: Data Mining
Sponsored Session

Chair: Seoung Bum Kim, Assistant Professor, Korea University, Anam-dong Seongbuk-Gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

1 - Oil Price Prediction From Influence Propagation

Hyunjung Shin, Assistant Professor, Ajou University, Suwon, Korea, Republic of, shin@ajou.ac.kr, Kanghee Park, Tianya Hou

Oil price prediction can become difficult and challenging particularly when the price fluctuates from irregular external factors— supply/demand-side shocks, political conflicts in the Middle East, and influences from other economical indices, etc. If the relationship between the oil price and those external factors is identified and quantified, the prediction may provide more relevant results. We implement this idea to crude oil prices of West Texas Intermediate using Semi-Supervised Learning.

2 - Dynamic Kernel-based Ridge Regression for Autocorrelations of Response Variables

Young-Seon Jeong, PhD Candidate, Rutgers, the State University of New Jersey, United States of America, ysjeong@eden.rutgers.edu, Myong K. (MK) Jeong, Norman Kim

We present a dynamic kernel ridge regression that combines kernel ridge regression with lagged dependent variables (LDVs) to improve the prediction accuracy when the dependent variables are autocorrelated and data are high-dimensional. Experimental results show that the proposed approaches with LDVs perform better than several conventional regression models.

3 - Using Classification and Regression Trees to Predict Ozone Concentration

Durai Sundaramoorthi, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu

Elevated levels of ground-level ozone are hazardous to the health of people and the environment. In this research, data was gathered for nine different variables from seven monitoring sites in the Dallas-Fort Worth. Classification and Regression Tree, a data mining tool for prediction and classification, was used to study the effect of environmental predictor variables on Ozone concentration.

■ WC05

C-Room 23C, Upper Level

Discussion Session: Recent Progress in Variation Reduction Methodologies for Manufacturing Processes

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706-1572, United States of America, szhou@engr.wisc.edu

1 - Discussion Session: Recent Progress in Variation Reduction Methodologies for Manufacturing Processes

Shiyu Zhou, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706-1572, United States of America, szhou@engr.wisc.edu

In this session, we will present some new progresses in variation reduction technologies for manufacturing processes. Particularly, we will focus on the recently developed "Stream of Variation (SoV)" methodologies for dimensional variation reduction for multistage machining and assembly processes.

■ WC06

C-Room 24A, Upper Level

Advances in Control Charting Methods

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Adel Alaeddini, Wayne State University, Wayne State University, Detroit, MI, 48220, United States of America, adel.alaeddini@gmail.com

1 - Shift-preserving Residual Control Charts for Multivariate Autocorrelated Data

Giovanna Capizzi, Associate Professor, Department of Statistical Sciences, via C. Battisti 241, Padova, Italy, capizzi@stat.unipd.it, Guido Masarotto

One approach for monitoring autocorrelated data consists in applying a control chart to the residuals of dynamic models. However, due to the forecast recovery effect, the response to process mean shifts can be attenuated in the residuals. To try to overcome this problem, we suggest a simple modification to the standard residuals. Comparisons, based on two real industrial cases, show that the modification can enhance the ability to detect small and medium mean shifts.

2 - Using Hidden-Markov Models for the Design of Control Charts

Adel Alaeddini, Wayne State University, Wayne State University, Detroit, MI, 48220, United States of America, adel.alaeddini@gmail.com, Kai Yang

Effective use of control chart requires an appropriate chose of the parameters: sample size, sampling interval, and control limits, which is known as the design of control chart. In some applications these parameters are fixed, however in other applications they are variable. In this paper we use Hidden-Markov processes for the design of control charts. For this purpose we develop a mathematical model that integrates variable sampling strategies with statistical run-rules.

3 - A Distribution-free Control Charting Method for Autocorrelated Processes

Hyeh-rin Choi, Kyung Hee University, Department of Industrial Engineering, Yongin-si, Korea, Republic of, hoynolja@naver.com

Many design schemes of control charts assume the known distribution of the underlying process, which is often violated in practice. We propose a distribution-free control charting scheme applied to autocorrelated processes without any prior process information. Simulation results show that the scheme outperforms others in detection capability and robustness.

■ WC07

C-Room 24B, Upper Level

Joint Session QSR/ HAS: Simulating Quality in Health Care

Sponsor: Quality, Statistics and Reliability & Healthcare Applications
Sponsored Session

Chair: John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

1 - It's My Turn: Real Life Constraints in Scheduling ORs

Gregory Feld, Director, Elecro-Physiology Labroatory, UC, San Diego School of Medicine, La Jolla, CA, United States of America, gfeld@ucsd.edu

This session will describe, from cardiologists standpoint, the political, financial, and staffing constraints that impact OR scheduling. Challenges to the Operational Research field will be reviewed and why many methodological studies are both brilliant and wrong.

2 - Simulating Quality and Patient Flow Characteristics in Ambulatory Care

Dave Goldsman, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, sman@isye.gatech.edu

The complex interactions between patient arrival patterns, patient scheduling schemas and patient flow are ideally suited for simulation. Critical elements include how one quantifies tardiness, inter-arrival patterns and assumptions about service capacity. Impact on quality of care will be demonstrated with several case studies

3 - Developing a Theory of Quality for Health Care: Notes From the Field

John Fontanesi, Director, University of Califonia SD, San Diego, CA, United States of America, jfontanesi@ucsd.edu

Rising costs, medical errors, inconsistent adoption of known best practices make daily headlines. Paralleling these realities are a number of initiatives attempting to address quality of care. All have either have or are in jeopardy of failing. This presentation will argue that absent a coherent theory of health care quality, such

efforts risk adding tampering casue variation to an already highly variable system. A mathematical model of heath care quality will be offered for review.

4 - Using (or Not Using) Industrial Engineering/Operations Research Modeling Tools in Public Health

Michael Washington, Deputy Director, Preparedness Modeling Unit, CDC\NCEH-ATSDR/OD, 4770 Buford Hwy, NE, MS F-59, Chamblee, GA, 30341, United States of America, mtw4@cdc.gov

This presentation will discuss some past and future public health projects in which industrial engineering/operations research modeling tools were used, and some were used to make medical and policy decisions. In addition, we will discuss challenges that have prevented or delayed projects from moving forward because little political support. We will discuss the consequences of these decisions.

■ WC08

C-Room 24C, Upper Level

Data Mining Approaches for Biomedical Problems

Sponsor: Data Mining
Sponsored Session

Chair: Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petros.xanthopoulos@gmail.com

1 - Nonlinear Time Series Analysis for Identifying Non-Convulsive Status Epileptics

Jicong Zhang, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, University of Florida, Gainesville, FL, 32611-6595, United States of America, jicong@ufl.edu, Chang-Chia Jeff Liu, Panos Pardalos, Petros Xanthopoulos

Distinguishing between non-convulsive status epilepticus (NCSE) and toxic metabolic encephalopathy (TME) is a clinically challenging problem. Accurate and timely identification of NCSE is important. Nonlinear time series analysis and dynamical system modeling were applied to derive features to help identify NCSE patients from TME patients. Results showed clear separation between the two groups, which indicate the identification ability (btw NCSE and TME) of dynamical measures.

2 - Direct Multigroup Approaches of Clustering for Microarray Data

Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, andynfan@ufl.edu, Panos Pardalos

In this paper, a direct approach based on mixed integer programming of clustering to more than two parts is proposed. To solve this mixed integer programming, the relaxations in the forms of spectral graph theory, linear programming and semidefinite programming are used. Finally, we use the data from microarray to compare these relaxations.

3 - Predicting Cognitive Impairment and Alzheimer's Disease

Tsung-Lin Wu, Georgia Tech, 765 Ferst Avenue, Atlanta, GA, 30332, United States of America, tlwu@isye.gatech.edu, Eva Lee

In this work, we present predictive algorithms to predict the cognitive status of individuals. Clinical data of three classes of patients (healthy, mild cognitive impairment, and Alzhemiers') are used. Identifying the earliest stage of mild-cognitive impairment is critical as it allows for early treatment that can slow down or stop progression into Alzheimer's Disease. Exciting results are obtained on a group of individuals. This work is joint with Dr. Levey's team at Emory.

4 - Deconvolution of Signals by Combining Curve Fitting and Signal Separation with Applications

Pando Georgiev, University of Florida, Center for Applied Optimization, Gainesville, FL, 32611, United States of America, pandogeorgiev@gmail.com

We present a new method for deconvolution of signal mixtures by combining a new deflation procedure for Blind Signal Separation problems and curve fitting techniques. It allows to separate mixtures which could not be separated by Independent Component Analysis techniques. Applications are presented for deconvolution of peaks in Raman spectroscopy.

■ WC09

C-Room 25A, Upper Level

Control of Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Hayriye Ayhan, Associate Professor, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States of America, hayhan@isye.gatech.edu

1 - Optimal Admission Control for Tandem Queues with Loss

Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, bozhang@gatech.edu, Hayriye Ayhan

We consider two finite-buffer single-server queues in tandem. A gatekeeper decides to accept or reject each arriving customer. An accepted customer who finds a full buffer at either station leaves the system and a station-dependent cost is incurred; a rejection incurs the same cost as a loss at station 1. We provide a complete characterization of the optimal admission control policy for minimizing the long run average cost in special cases, and present conjectures and examples for general cases.

2 - Inspection Location in Capacity-constrained Serial Lines

Salih Tekin, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, stekin@gatech.edu, Sigrun Andradottir

We consider the effects of inspection and repair stations on production capacity and product quality in serial lines with possible inspection and repair following each operation. We allow multiple defect types, defect-dependent inspection errors, and fractional inspection. Our analysis captures the possibility of increasing production capacity by scrapping or repairing defective items before a bottleneck operation, and hence reducing the waste of operation capacity on defective products.

3 - Adaptive Simulation/LP Methods for Queueing Network Control

Mike Veatch, Gordon College, 255 Grapevine Rd, Wenham, MA, 01984, United States of America, mike.veatch@gordon.edu

Differential cost function approximations are used for average cost queueing network control. We propose an adaptive algorithm that iteratively improves the approximation by adding basis functions selected from a fixed set based on a simulation. Linear programming (or other approximate dynamic programming methods) fits the differential cost at each iteration.

4 - Fleet Sizing for a Vehicle Rental Service via Closed Queueing Network Analysis

Cathy Xia, Associate Professor, The Ohio State University, ISE, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Dave George

We consider the problem of fleet sizing for a vehicle rental service in which probabilistic movement of vehicles among locations is a prominent feature of the network. Fleet size should be optimal with respect to the relevant costs, while meeting quality-of-service targets desired by the customers. We analyze the system as a closed queueing network, obtaining a product-form model under certain assumptions, and provide solution methods based on steady-state analysis.

■ WC10

C-Room 25B, Upper Level

Heuristics for Assignment Problems

Contributed Session

Chair: Said Hanafi, Professor, University of Valenciennes, LAMIH-SIADE, Le Mont Houy, Valenciennes, 59313, France, said.hanafi@univ-valenciennes.fr

1 - Path-Relinking (PR) as a Diversification Mechanism for Quadratic Assignment Problem (QAP)

Thashika Rupasinghe, Clemson University, 110 Freeman Hall, Clemson, SC, 29634-0920, United States of America, rthashi@clemson.edu, Mary Beth Kurz

QAP is widely researched because of its complexity, variety of applications and theoretical importance. Among the different solutions approaches utilized, metaheuristics show promising results. PR mechanisms are used for improving solutions of generic metaheuristics. This study investigates the effectiveness of PR in two path-based and two population-based metaheuristics.

2 - Parallel Heuristic-based Algorithms for the Multidimentional Assignment Problem

Alla Kammerdiner, Visiting Assistant Professor, Arizona State University, 1711 S. Rural Road, Tempe, AZ, 85287, United States of America, akammerd@asu.edu

The multidimensional assignment problem (MAP) is a hard combinatorial optimization problem. A wide range of problems can be formulated as a case of the MAP, including data association problem arising in military applications, such as sensor fusion and target tracking. Since exact approaches are slow for the MAPs with large parameters, heuristics have recently become increasingly popular. We present new parallel algorithms for solving the MAP using nature inspired Monkey Search metaheuristic.

3 - An Epsilon-constraint Based Heuristic for Multi-objective Assignment Problems

Heidi Taboada, Assistant Professor, Department of Industrial Engineering, The University of Texas at El Paso, 500 West University Avenue El Paso, El Paso, TX, 79968-0521, United States of America, hataboada@utep.edu, Mihalis Golias

An efficient Epsilon-constraint based heuristic for approximating the Pareto set of multi-objective unrelated machine scheduling problems by solving a series of constrained single objective problems is presented. In this presentation we also discuss the implications and applicability of exact algorithms, similar to the one presented, as resolution approaches for multi-objective problems when the single objective counterparts are NP-hard.

4 - Application of Evolutionary Computation to Intermodal Transporation at Mexico's Ports

Jaime Mora-Vargas, Head Graduate Program in Industrial Engineering, ITESM, Carr. Lago de Guadalupe km 3.5, col. margarita maza de juarez, atizapan, 52926, Mexico, jmora@itesm.mx, Miguel Gonzalez-Mendoza

Research for intermodal transportation has increased in the last years, considering the inherent complexity of the service. This paper presents an overview of intermodal transportation at Mexico with particular emphasis of containers movements at ports. On average, at Mexico, seven days spends a container at port, this time results for the several actors involved in the process. A proposal for use an evolutionary computation application to minimize timespan spended by containers is presented.

5 - Several Versions of DTT for Large-scale Unconstrained Binary Quadratic Problems

Said Hanafi, Professor, University of Valenciennes, LAMIH-SIADE, Le Mont Houy, Valenciennes, 59313, France, said.hanafi@univ-valenciennes.fr, Mustapha Ratli, Christophe Wilbaut

Many works have been proposed to solve the unconstrained binary quadratic programs (UQP). Glover, Alidaee, Rego and Kochenberger (2002) proposed one-pass heuristics as alternatives to the well-known DDT method of Boros, Hammer and Sun (1989) for large-scale UQP. We propose an efficient implementation of the DTT and alternative heuristics with local search for UQP. Computational experiments performed on large instances show the efficiency of our implementation in terms of quality and CPU time.

■ WC11

C-Room 25C, Upper Level

Data Mining

Contributed Session

Chair: Alkis Vazacopoulos, Vice President, FICO, 202 Parkway, Harrington Park, NJ, 07640, United States of America, alkisvazacopoulos@fico.com

1 - A Computational Method for Discovering Root Causes From Symptoms

Casey Diekman, PhD Candidate, University of Michigan Department of Industrial & Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, diekman@umich.edu, Vijayan Nair

In many applications, one observes a (high-dimensional) vector of symptoms associated with units, and the goal is to discover the underlying small number of root causes. The motivating example in our case is an automotive assembly process with various types of assembly defects. Existing unsupervised learning techniques, such as clustering, are not effective in discovering the root cause structure. We propose a new algorithm for mapping the symptoms to underlying root causes, study the properties of the algorithm, and demonstrate its effectiveness on some examples.

2 - Can Delay Propagation Be Predicted? A Comparison of Neural Network with Regression Analysis

Akira Kondo, Senior Research Analyst, Federal Aviation Administration, 800 Independence Ave., SW, APO-100, Washington, DC, 20591, United States of America, akira.kondo@faa.gov, Tony Diana

The present study compares the capability of neural networks and regression analysis to predict propagated delays. It examines the factors most likely to affect the propagation of delays of flights departing from EWR in summer 2007 and summer 2008. The regression models in both summers feature a lower propensity to errors compared with neural networks.

3 - Advances in Core Vector Machines Technology

Alkis Vazacopoulos, Vice President, FICO, 202 Parkway, Harrington Park, NJ, 07640, United States of America, alkisvazacopoulos@fico.com, Frank Elliot

After decades of academic research, support vector machines are now being industrialized. Problems in banking and related fields, however, pose a special problem because of the large numbers of records in their data sets. We compare the performance of Core Vector Machines and Neural Networks, a favorite technology in credit card fraud modeling and demonstrate an advantage of Core Vector Machines on complex data sets.

■ WC12

C-Room 26A, Upper Level

Modeling Systems and Languages

Contributed Session

Chair: Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com

1 - Analyzing the Price Negotiation with Vibrational Model

Deokkyo Oh, PhD student, Texas Tech, Area of ISQS, Box 42101, Lubbock, 79409, United States of America, deokkyo.oh@ttu.edu

This research is to find the isomorphism between the price negotiation and vibration model with damper and spring and to analyze the price negotiation with vibration engineering.

2 - Spreadsheet Modeling for Solving Mixed Integer Programming

Pandelis Ipsilandis, Professor, Technological Education Institute, School of Business, Larissa, 41110, Greece, ipsil@teilar.gr

Spreadsheets became very powerful and easy to use tools in applying analytical techniques for solving business problems allowing organizations to apply OR methodologies without the presence of specialized software. This paper examines an efficient approach for solving combinatorial programming problems with the use of spreadsheets. The approach is applied in a spreadsheet-based DSS, for solving the Multi Item Procurement Problem with Fixed Vendor Cost.

3 - Parallel Computing for Mixed Integer Programming Using Xpress

Gabriel Tavares, Senior Consultant, FICO, 200 Smith Ranch Road, San Rafael, CA, 94903, United States of America, gabrieltavares@fico.com, Yuri Smirnov, Alkis Vazacopoulos

Xpress-MP features sophisticated, robust algorithms to quickly and accurately solve industry's most demanding Mixed Integer Programming Problems (MIPs) with millions of variables and constraints. Xpress Parallel-MIP harnesses the power of multi-core machines to give impressive performance improvements over a large set of models. In this work we investigate the impact of using parallel computing to reduce the solution times across different types of MIPs derived from real world applications.

4 - Graphical Tools in AIMMS to Analyze MINLP/NLP Optimization Models

Peter Nieuwesteeg, Senior AIMMS Specialist, AIMMS (Paragon Decision Technology), 5400 Carillon Point, Kirkland, WA, 98033, United States of America, p.nieuwesteeg@aimms.com

Making a mistake while building a model is easy. Finding out what is wrong is more difficult, especially with nonlinear models. The AIMMS Math Program Inspector (MPI) is a unique graphical tool that allows you to analyze any LP/MIP/NLP model. The goal here is to show how AIMMS can help you gain insight into the model using the MPI by analyzing (selected) variables and constraints, and the substructure causing infeasibility. It even offers the ability to change coefficients and resolve.

5 - AMMLE:Advanced Math Modeling Language Tool Using Eclipse

Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com, David Jensen, Heng Cao, Chen Jiang

Towards bridging the gap between prototyping and development, we present AMMLE: a new approach to seamless generation of production level code using the COTS(commercial off-the-shelf) solvers. Using some examples, we show that there are significant time savings that can be achieved using a high level math programming interface for prototyping and then automating the generation of production code. We look at the initial work we have done and describe the future direction.

■ WC13

C-Room 26B, Upper Level

Data Mapping Frameworks for Interfacing Modeling System Data to Other Tools

Sponsor: Computing Society
Sponsored Session

Chair: Steven Dirkse, Director of Optimization, GAMS Development Corporation, 1217 Potomac Street NW, Washington, DC, 20007, sdirkse@gams.com

1 - GAMS Data Exchange (GDX) Tools and Utilities
Paul van der Eijk, Software Engineer, GAMS Development, 1217 Potomac St NW, Washington, DC, 20007, United States of America, pvandereijk@gams.com

Overview of GDX format. Viewing and using GDX files with GAMS. Moving data between applications using the GDX API. Automatic generation of data interfaces.

2 - New MPL Data Readers for GAMS GDX Files and AMPL Data Files
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

It is a well-known fact, that managing, transforming, and preparing the data is often the most challenging aspect of optimization modeling. One way to resolve this, is to try to work with existing data and share it between applications in the original format. In this presentation, we will introduce new data features for the MPL Language, including readers for both standard GAMS GDX binary files and AMPL data files, allowing the same data to be easily shared between different modeling languages.

3 - Data and Software Interoperability with GAMS: A User Perspective
Erwin Kalvelagen, Amsterdam Optimization, 3625 R ST NW, Washington, DC, 20007, United States of America, erwin.kalvelagen@gmail.com

We describe some new features in GAMS that help in unlock software libraries and data exchange tools. This interoperability will allow us to add functionality to GAMS in a simple and quick fashion. Some motivating examples will be shown.

4 - GAMS Branch-and-cut and Heuristic Facility
Michael Bussieck, GAMS Development Corp, 1217 Potomac St NW, Washington, DC, 20007, United States of America, mbussieck@gams.com

Models with discrete variables can significantly benefit from user supplied routines that generate cutting planes and good integer feasible solutions. The BCH facility introduced in 2004 automates all major steps necessary to define, execute, and control user defined routines within general purpose optimization codes. The major benefit of the facility is the mapping between the solver and model name space. New BCH features include solution filters and support for branch-and-price.

■ WC14

C-Room 27A, Upper Level

Hybrid Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

1 - Connections in Networks: A Hybrid Approach
Willem-Jan van Hoeve, Assistant Professor of Operations Research, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, vanhoeve@andrew.cmu.edu, Ashish Sabharwal, Carla P. Gomes

We consider the connection subgraph problem, which occurs e.g., in resource environment economics and social networks. We first focus on the hardness of this problem in light of its competing (in)feasibility and optimization components. Then we present a two-phase hybrid method to find scalable solutions. We present results for semi-structured instances as well as on real data used for the construction of a wildlife corridor in the Northern Rockies.

2 - Online Selection of Quorum Systems for RAMBO Reconfiguration
Laurent Michel, Associate Professor, University of Connecticut, 371 Fairfield Rd, Storrs, CT, 06269, United States of America, ldm@engr.uconn.edu, Pascal Van Hentenryck

Rambo is an algorithm that implements atomic read/write shared memory in dynamic networking environments. Rambo deals with volatile environments such as civilian rescue, military operations, or mobile networks. To maintain availability and consistency, Rambo replicates objects and uses reconfigurable quorum systems. This talk addresses the reconfiguration problem with three approaches based on CP, an hybrid master-slave decomposition and a parallel solution to find (near) optimal configurations.

3 - MDD-Based Propagation of Among Constraints
Samid Hoda, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, shoda@andrew.cmu.edu, Willem-Jan van Hoeve, John Hooker

Fixed-width MDDs were introduced recently by Hooker et al. as a more refined alternative for the domain store to represent partial solutions to CSPs. We study MDD-filtering algorithms for among and sequence constraints.

■ WC15

C-Room 27B, Upper Level

Hidden Linearity, Hidden Convexity, and Hidden Separability in General Nonlinear Programming — Uncovered, Reformulated, and then Transformed for Both Qualitative and Quantitative Exploitation II

Sponsor: Computing Society
Sponsored Session

Chair: Elmor Peterson, Systems Science Consulting, United States of America, elmor.peterson@gmail.com

1 - Additional Duality Relations for Some Direct Extensions of Prototype Geometric Programming
Jayant Rajgopal, University of Pittsburgh, 1048 Benedum Hall, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States of America, rajgopal@pitt.edu, Ya-Ping Wang

These direct extensions (which preserve the important linearity, convexity, and separability properties of PGP) include: (1) "posy-monomial" equality constraints, (2) simple upper and/or lower-bound constraints on the decision variables, and (3) "posynomials" with infinitely many terms.

2 - The Maximization of Expected Profit in Stochastic Activity Networks with Discounting
Clayton Morgan, PhD Candidate at NC State University, Sony Ericsson, 5534 Vista View Ct, Raleigh, NC, 27612, United States of America, Clayton.Morgan@sonyericsson.com, Salah Elmaghraby

A "project" is viewed as a sequence of both negative cash flows (costs) and positive cash flows (completion payments). Modeling the corresponding stochastic case leads to random times for cash flow occurrence and activity duration. The goal is to solve the resulting stochastic optimization problem where the decisions are target completion times, and the objective is to maximize the expected discounted profit. The problem is cast as a "posynomial" GP to facilitate an expedient numerical solution.

3 - Identifying and Exploiting Always Binding Inequality Constraints in NLP
Robert Abrams, Professor Emeritus, University of Illinois at Chicago, Information and Decision Sciences, Chicago, IL, 60607-7124, rabrams@uic.edu, Jane Hagstrom

Inequality constraints that actually hold as equalities over the entire feasible-solution set can provide a useful reduction in dimensionality for some classes of NLP problems — by replacing the always binding inequality constraints with appropriate linear equality constraints. Originally used in geometric programming and then extended to more general convex programming, this methodology has recently been applied to finding better-than-equilibrium traffic flows.

■ WC16

C-Room 28A, Upper Level

Search Engine Marketing

Sponsor: Information Systems
Sponsored Session

Chair: Raymond G. Sin, HKUST, Department of ISOM, HKUST, Clear Water Bay, Hong Kong - ROC, rsin@ust.hk

1 - Sensible Judgement, Insensible Consequences: Welfare Implications of Search Engine Optimization

Raymond G. Sin, HKUST, Department of ISOM, HKUST, Clear Water Bay, Hong Kong - ROC, rsin@ust.hk, Stephen Shum

The intense competition on search engine results pages has led to the proliferation of search engine optimization (SEO). Increasingly, firms invest in SEO to manipulate their rankings in the organic search areas in order to improve traffic to their websites. In this study, examine the impacts of SEO investments on competition and consumer welfare. We conclude with a set of recommendations to search engine operators and regulators.

2 - Competing Keyword Auctions

De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E, Lexington, KY, 40506, United States of America, de.liu@uky.edu, Jianqing Chen, Andrew Whinston

Most studies of keyword auctions examine optimal auctions under the assumption that an auctioneer faces no competition. This paper moves beyond a monopolistic view to study a duopoly setting. A unique characteristic of our analysis is to allow one auctioneer to rank advertisers by their pay per click whereas the other weighs pay-per-click by "quality score" (or their expected click-through-rate). We examine advertisers' entry into each auction and study the equilibrium of auctioneers' game.

3 - Revenue Estimation for Customer Leads Under Missing Information

Hemant Bhargava, University of California-Davis, 135 AOB IV, Davis, CA, United States of America, hemantb@ucdavis.edu, Catherine Yang

Lead marketplaces buy and sell customer leads, and must predict the likely revenue for a lead when making the buy decision. In the absence of live bids, revenue predictions can be made from past sales. We develop methods for estimating revenue when relevant historical data are missing.

4 - Performance-based Advertising on the Search Engines: Advertising as a Quality Signal

Jane Feng, Assistant Professor, University of Florida, 360 Stuzin Hall, Gainesville, FL, 32611, United States of America, jane.feng@cba.ufl.edu, Jinhong Xie

Performance-based advertising is becoming increasingly popular in the search engine industry, where advertisers pay the publisher only when an 'action' (e.g., a click-through or a purchase) is generated by the advertisement. We study the impact of such advertising on advertisers' signaling behavior and publishers' advertising revenue.

■ WC17

C-Room 28B, Upper Level

E-Business/Commerce II

Contributed Session

Chair: Yanliang Qi, New Jersey Institute of Technology, 10 Alpine Pl, Kearny, NJ, 07032, United States of America, tony.qyl@gmail.com

1 - Verification of the Reliability and the Validity on the Appraisal Factors for Evaluating e-Customers

Atsushi Kimura, Student, The Kyoto college of Graduate Studies for Informatics, 7 Monzen-cho Tanaka Sakyo-ku Kyoto 606-8, 7 Monzen-cho Tanaka Sakyo-ku Kyoto 606-8, Kyoto, 606-8225, Japan, st030834@m1.kcg.edu, Nguyen Truc, Hong Seung Ko, Haruki Takada

For evaluating e-Customers value on the Internet, we developed the appraisal criteria and factors, and verified the reliability and the validity of the appraisal criteria and factors by the nomological validity and the causality analysis. Furthermore, for the companies' profitable sales, we'll select the royal e-Customers by using appraisal factors.

2 - Consumer Search and Propensity to Buy: A Study of Internet Users on a Popular Hi-tech Website

Ofer Mintz, PhD Student, University of California, Irvine, 318 SB, Irvine, CA, United States of America, omintz@uci.edu, Ivan Jeliazkov, Imran Currim

In this article we investigate the association between a consumer's pattern of information search and their propensity to buy in a field setting. To analyze our conjectures, we construct a new Bayesian simultaneous equation model that, unlike previous simultaneous equation models, can incorporate dependent variables that are binary and censored.

3 - A Study on the Long-tail Phenomenon Using ABM Method

YoonSoo Bae, PhD Student, KAIST, KAIST SUPEX S291, ChungRyangRi 2Dong, DongDaeMoonGu, Seoul, Korea, Republic of, bluebys@business.kaist.ac.kr, Jae-Hyeon Ahn

Long-tail concept is derived by the e-commerce. Because of the lower search cost and displaying marginal cost, the market of the niche product grows bigger and bigger. But there is not enough research on the long-term dynamics of this long-tail economics. The purpose of this research is to investigate the long-tail phenomenon over the consumer purchasing behavior by using agent-based modeling approach.

4 - Key Factors in Customer Decision Model

Yanliang Qi, New Jersey Institute of Technology, 10 Alpine Pl, Kearny, NJ, 07032, United States of America, tony.qyl@gmail.com

Through comparison between IT service and financial service, we try to explore the key factors in customer decision model. To face a service, what factors will have the big influence on consumer's decision, buy or not?

■ WC18

C-Room 28C, Upper Level

Network Design and Routing

Sponsor: Telecommunications
Sponsored Session

Chair: Steven Low, Professor, California Institute of Technology, 1200 E California Blvd, MC 256-80, Pasadena, CA, 91125, United States of America, slow@caltech.edu

1 - Single-path Routing in TCP/IP Networks

Steven Low, Professor, California Institute of Technology, 1200 E California Blvd, MC 256-80, Pasadena, CA, 91125, United States of America, slow@caltech.edu, John Pongsajapan, Ao Kevin Tang, Meng Wang, Chee-Wei Tan

We show TCP/IP maximizes delay-sensitive utility over both source rates and routes. We exhibit some counter-intuitive properties that such delay-sensitive utility functions possess. While the network utility maximization (NUM) problem with multi-path routing is polynomial-time, NUM with single-path routing is NP-hard. The loss in utility is exactly the duality gap between single-path NUM and its dual. We bound this cost of not splitting and show that it is independent of the number of users.

2 - Generating Improved Routing Policies under Active Congestion Control and Demand Fluctuations

Stanko Dimitrov, University of Michigan - Ann Arbor, 1205 Beal Ave, 2818 IOE, Ann Arbor, MI, 48109, United States of America, sdimitro@umich.edu, Dushyant Sharma, Marina Epelman

We propose a model for active congestion control in a computer network. Though the proposed model is NP-hard, we show that routing polices generated using the model outperform those currently deployed in a real world network. We extend our model by taking into account natural demand fluctuations in the computer network and show that a single robust routing policy outperforms routing policies currently used in a computer network.

3 - Developing a Ring-based Optical Network Structure - A Case Study

Stefan Voss, Professor, University of Hamburg, IWI - Institute of Information Systems, Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@hamburg.de

We consider structural properties of optical networks. It is common that 1+1 protection is required in telecommunication applications. This property is naturally ensured by ring structures and we address the questions of how to design ring networks and if they show a good behavior in terms of hardware and handling costs. We present ongoing research based on a case study with Deutsche Telekom.

4 - Network Restoration under Single Link or Node Failure Using Preconfigured Virtual Cycles

Hanan Luss, Senior Scientist, Telcordia Technologies, One Telcordia Drive, Piscataway, NJ, 08854, United States of America, hluss@telcordia.com, David Shallcross, Martin Eiger

We present a method for end-to-end path protection to multiple demands under a link or node failure in optical networks. One restoration route per demand with specified restoration wavelengths is assigned on a cycle segment. Many candidate preconfigured cycles are generated, where each cycle may protect multiple disjoint demands and demands with common failure scenarios. A near-optimal set of cycles is selected by solving a set covering problem. Conflicts of wavelength assignments are resolved.

■ WC19

C-Room 28D, Upper Level

Traffic Management II

Contributed Session

Chair: Wenteng Ma, Citilabs, Inc., 1040 Marina Village Parkway, Alameda, CA, 94501, United States of America, wma@citilabs.com

1 - Optimization of Network Congestion Control with Variable Travel Demands

Suh-Wen Chiou, National Dong Hwa University, 1 Dasheu Road sec 2, Hualien, 97401, Taiwan - ROC, chiou@mail.ndhu.edu.tw

Optimization for road network congestion control is considered. The underlying behavior of users' route choice is taken into account. Such problem can be formulated as a non-linear optimization problem with equilibrium constraints. A novel solution scheme is proposed to minimize traffic congestion and travel delays. Numerical calculations are conducted on an example road network.

2 - Passenger Traffic in Elevators

Juha-Matti Kuusinen, Researcher, Systems Analysis Laboratory, Helsinki University of Technology, PO Box 1100, Espoo, 02015, Finland, juha-matti.kuusinen@tkk.fi, Marja-Liisa Siikonen, Harri Ehtamo, Janne Sorsa

We present a new approach to passenger traffic in elevators, based on passenger journeys. A passenger journey is a batch of passengers whose departure and destination floor are known. Our approach enables the approximation of the passenger arrival process and the floor-to-floor definition of the traffic. In our case study, arrivals seem to be compound Poisson, thus generalizing the earlier assumption. We shall discuss implications of this result to elevator planning, simulation and control.

3 - Comparison Between Bar-Gera's and Aashtiani's Methods for Solving the Traffic Assignment Problem

Wenxin Qiao, University of Maryland-College Park, 1179 Glenn L. Martin Hall, University of Maryland, College Park, MD, 20742, United States of America, wxqiao@umd.edu, Ali Haghani, Shahab Toobaie, Rafael Olarte

Executing an algorithm that solves the traffic assignment problem can take, for a city like Chicago, twenty-four hours in computing time. Here, we compare perhaps the newest and fastest existing method, Bar-Gera's Method, with an old but improved one, Aashtiani's Method. Specifically, we compare their computing speeds when applied to thirteen city networks. Results suggest that the complexity of the network favors Aashtiani's method while the desired accuracy favors Bar-Gera's Method.

4 - A Hybrid Genetic Algorithm for Road Congestion Minimization

Luciana S. Buriol, Associate Professor, Federal University of Rio Grande do Sul, Avenida Bento Gonalves, 9500, Instituto de Informatica, Porto Alegre, 91501970, Brazil, buriol@inf.ufrgs.br, Mauricio G. C. Resende, Michael J. Hirsch, Marcus Ritt, Tania Querido, Panos Pardalos

One of the main goals in a transportation planning is to achieve solutions for two classical problems: the traffic assignment problem, which minimizes the travel delay among all travelers, and the toll pricing problem which settles, based on data derived from the first problem, the tolls that would collectively benefit all travelers and would lead to a user equilibrium solution. In this article, we propose an approach to solve the two problems jointly, making use of a Genetic Algorithm.

5 - Optimizing Signal Timing Plan and Lane Allocation Pattern at Signalized Intersections

Wenteng Ma, Citilabs, Inc., 1040 Marina Village Parkway, Alameda, CA, 94501, United States of America, wma@citilabs.com

Existing research works have been concentrated on signal optimization, and few of them consider the impact of lane allocation pattern. This research proposes a GA model for the integration design of signal timing plan and lane allocation pattern. Fully optimized intersection designs, including cycle lengths, phase durations, phase sequences, permitted movements, lane allocations, and shared movements, can be generated based on assigned traffic flows and geometric properties at intersections.

■ WC20

C-Room 28E, Upper Level

Maritime Inventory Routing

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Kevin Furman, ExxonMobil, 3120 Buffalo Speedway, URC-URC-C328, Houston, TX, 77098, United States of America, kevin.c.furman@exxonmobil.com

1 - A Branch-and-price Algorithm for the Liquefied Natural Gas Inventory Routing Problem

Henrik Andersson, Norwegian University of Science and Technology, Alfred Getz veg 3, Trondheim, Norway, henrik.andersson@iot.ntnu.no, Marielle Christiansen, Guy Desaulniers

We will present a new model and branch-and-price algorithm for the liquefied natural gas inventory routing problem. The problem includes inventory management and ship routing and scheduling aspects as well as complex technical considerations. The proposed algorithm takes advantage of a new decomposition scheme when searching for candidate columns. Computational studies show promising results.

2 - Stochastic Optimization for Maritime Logistics: A Decision Tree Approach

Eystein Fredrik Esbensen, PhD Student, Norwegian University of Science and Technology, Alfred Getz vei 3, Sentralbygg 1; 12 etg, Trondheim, 7491, Norway, eysteinf@iot.ntnu.no, Kjetil Fagerholt, Bjorn Nygreen, Lars Magnus Hvattum

A real-world shipping company faces a dynamic and highly stochastic scheduling problem for its dry bulk operations. The structure and conditions of this problem make it practical to use a brute-force approach: a decision tree. A simulator is used to create problem instances, build the decision tree, evaluate solutions and eventually to evaluate the method itself. Preliminary tests indicate that the proposed method works well and can provide good decision support.

3 - A Rolling Horizon Heuristic for an LNG Inventory Routing Problem

Jorgen Glomvik Rakke, PhD Student, NTNU, Alfred Getz vei 3, Trondheim, 7491, Norway, jorgen.rakke@iot.ntnu.no, Magnus Stalhane, Marielle Christiansen

A combined large scale ship routing and inventory management problem for a producer of liquefied natural gas (LNG) is presented. There is a single liquefaction plant and loading port with limited storage and berth capacities. We discuss how to create an Annual Delivery Program to fulfill long-term contracts at minimum cost while maximizing expected marginal contribution from selling LNG in the spot market, and present a mathematical model utilizing the underling transportation network.

4 - A Practical Approach to a Maritime Inventory Routing Problem

Kevin Furman, ExxonMobil, 3120 Buffalo Speedway, URC-URC-C328, Houston, TX, 77098, United States of America, kevin.c.furman@exxonmobil.com, Jin-Hwa Song

We introduce a practical problem for simultaneous optimization of ship routing and inventory management of a bulk product. Even though this ship inventory routing problem and the conventional IRP have similar structures, differences arise in various characteristics such as complex routing and time dependent costs, cargo draft limits at ports and allowing routes with multiple pick-ups & drop-offs. We develop models and practical heuristic algorithms which address these various real-world issues.

■ WC21

C-Room 30B, Upper Level

Flow Allocation in Transportation

Contributed Session

Chair: Gen-Han Wu, PhD Candidate, Pennsylvania State University, 265 Blue Course Drive Apt 25B, State College, PA, 16803, United States of America, guw109@psu.edu

1 - Modeling Truck Flows in North Dakota under Highway Load Restrictions

Subhro Mitra, Upper Great Plains Transportation Institute, Upper Great Plains Transportation Instit, North Dakota State University, Fargo, ND, 58108, United States of America, subhro.mitra@ndsu.edu, Joseph Szmerekovsky

Load restrictions are imposed on the highway network of North Dakota during the spring thaw cycle. In a previous study done to model the truck flow the configuration of different truck types was kept constant for each individual origin-destination (OD) flow pair. In this study a development of the previous model is done by relaxing the consideration of fixed trucking configuration for each individual OD pair.

2 - A Novel Model for System Optimal Freight Flow Assignment for the National Highway Network

Sandeep Srivathsan, Graduate Research Assistant, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, sandeep.srivathsan@okstate.edu, Ricki Ingalls, Manjunath Kamath, Peerapol Sittivijan, Balabhaskar Balasundaram

As part of a research effort focused on modeling freight movement in Oklahoma, we formulate and solve the system optimal freight flow assignment problem. The objective is to minimize the total travel time over all commodities and O-D pairs in the US obeying capacity and flow balance. This talk will discuss the advantages of this modeling approach and computational strategies to deal with the size of the data, as well as nonlinearity in the objective function.

3 - The Z Transform of the Linear Car-following Model

Mostafa Ghandehari, Senior Lecturer and Graduate Advisor, University of Texas at Arlington, Civil Engineering, Box 19308, Arlington, TX, 76019, United States of America, ghandeha@uta.edu, Siamak Ardekani

The Z transform is used to analyze the differential-difference equation for the linear car-following model. After taking the Z transform a linear first order ordinary differential equation is obtained. The solution of differential equation will give the Z transform of the nth car in the platoon. Then the inverse Z transform will give analytic expressions for velocities and spacings of the n cars.

4 - Allocating Demand and Redistributing Empty Flow in the Car Rental Business

Gen-Han Wu, PhD Candidate, Pennsylvania State University, 265 Blue Course Drive Apt 25B, State College, PA, 16803, United States of America, guw109@psu.edu, Tom M. Cavalier

In the car rental business, it is necessary to address daily planning in the same pool region. Vehicle imbalance at different locations forces empty vehicles to be redistributed. We propose a network flow model to solve this problem. A modified mean value cross decomposition algorithm is introduced and validated.

■ WC22

C-Room 30C, Upper Level

Models in Transportation Safety

Contributed Session

Chair: Xiaoyu Zhu, University of Florida, 365 Weil Hall, P.O. Box 116580, Gainesville, FL, 32611, United States of America, shuxy03@ufl.edu

1 - A Value Based Model for Countermeasure Evaluation in Traffic Safety

Niloufar Sadat Mirhosseini, PhD Student, Rutgers University, Department of Industrial & Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, niloofar@eden.rutgers.edu, Mohsen Jafari, Muhammad Dayhim

In choosing the traffic safety improvement actions in a critical spot,the value of a countermeasure may be more important than its cost. To evaluate the countermeasure, many direct and indirect costs of a crash should be considered i.e. human costs, administration costs, insurance costs, medical costs and congestion costs. In this research, a model is presented to identify and integrate the most important costs of a crash to be used in the optimal countermeasure selection process.

2 - Plan4Safety - A Powerful Tool for Safety Professionals

Mohsen Jafari, Professor, Rutgers University, Department of Industrial & Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, jafari@rci.rutgers.edu, Niloufar Sadat Mirhosseini, Muhammad Dayhim

Plan4Safety is a multi-layer decision support tool for transportation engineers, planners, enforcement, and decision makers in New Jersey's transportation and safety agencies to analyze crash data in tabular & geospatial forms .This tool identifies crash hot spots which merit further investigation and prioritizes them for potential safety improvements. It determines the most promising alternative to maximize safety benefits given a budgetary constraint.

3 - Optimizing the Systematic Implementation of Transportation Safety Strategies

Hongyi Chen, University of Minnesota, 1305 Ordean Court, 105 VKH, Duluth, MN, 55812, United States of America, honchen@d.umn.edu

An algorithm is proposed to systematically optimize the implementation of transportation safety strategies. It first assesses the effectiveness of individual and a combination of strategies in decreasing the crash rate under different road conditions, and then suggests an optimized plan for the state department of transportation to implement in different areas. Database and software are also designed to continuously refine the assessment as more traffic data are collected.

4 - Multinomial Logit Model Applicated in the Location of Crashes

Xiaoyu Zhu, University of Florida, 365 Weil Hall, P.O. Box 116580, Gainesville, FL, 32611, United States of America, shuxy03@ufl.edu, Sivaramakrishna Srinivasan

The objective of this study is to model the location of crashes within work zones as a function of the lengths of the different work-zone segments, traffic volume, weather, and other exogenous factors. Data from crash reports were augmented with spatial attributes by using geographic information systems. The results from a multinomial logit model were used to construct the crash probabilities per lane-mile for the different work-zone segments.

■ WC23

C-Room 30D, Upper Level

OR Military Modeling Support Applications

Sponsor: Military Applications Society

Sponsored Session

Chair: Bill Nanry, Operations Analysis Group Lead, Lockheed Martin Missiles and Fire Control, 1701 W. Marshall Drive, Grand Prairie, TX, 75051, United States of America, william.nanry@lmco.com

1 - Econometric Frontier Analysis for New Technologies Using Decision Support Methodologies

Matthew Durchholz, Systems Engineer Senior Staff, Lockheed Martin Missiles and Fire Control, 1701 W. Marshall Drive, Grand Prairie, TX, 75051, United States of America, matthew.durchholz@lmco.com, Bill Nanry

This methodology uses a trades modeling approach that blends the voice of the customer, military usefulness, economic and business considerations to provide decision analysis capabilities when pursuing best architecture. The approach identifies an efficient frontier for best known technology mix, identifies any technology shortfall in meeting known requirements and allows rapid insertion of new technologies into the model to determine impact of that technology on system architecture trades.

2 - Identifying Top Level, Capability Assessment for an Integrated Air and Missile Defense System

Chris Larson, Systems Engineer Staff, Lockheed Martin Missiles and Fire Control, 1701 W. Marshall Drive, Grand Prairie, TX, 75051, United States of America, chris.larson@lmco.com

Lockheed Martin has developed an analysis model to mathematically explore a wide open trade space as a precursor for more focused analysis once the critical discriminators have been identified. This paper introduces the model, briefly explains the mathematical underpinning, and concludes with an example of how it has been applied to assess the top level integrated air and missile defense capabilities of a hypothetical country.

3 - Socio-cultural Training Through Behavioral Modeling in Interactive Games

Thomas Linehan, Director, Institute for Interactive Arts and Engineering, The University of Texas at Dallas, Richardson, TX, 75080-3021, United States of America, Thomas.Linehan@utdallas.edu

The "First Person Cultural Trainer," an interactive training game is presented. It is designed for troops to play prior to in-country deployment. The game has characters controlled by behavioral models. Each character has a personal,cultural profile with complex attitudes. The trainee's interactive performance is tracted, scored and reviewed.

■ WC24

C-Room 30E, Upper Level

Interdiction Models

Contributed Session

Chair: Michael Hirsch, Principal Scientist, Raytheon, P.O. Box 10128, M/S: 61, Largo, FL, 33773, United States of America, michael_j_hirsch@raytheon.com

1 - Network Interdiction of a Markovian Evader

Alexander Gutfraind, Cornell University, 657 Rhodes Hall, Ithaca, NY, 14853, United States of America, ag362@cornell.edu, Feng Pan, Aric Hagberg, David Izraelevitz

Network interdiction is a graph optimization problem arising in applications such as monitoring and nuclear arms control. In the network an "evader" moves from source node(s) to a target node along the least-cost path while an "interdictor" cuts edges. We introduce a novel model in which uncertainty causes the evader to follow a guided Markovian random walk to the target, and develop optimization heuristics based on betweenness centrality that can rapidly find high-quality solutions.

2 - A Game for Optimising Randomised Patrols: Analytic and Computational Results

Alec Morton, Lecturer in Operational Research, London School of Economics, Houghton St, London, WC2A2AE, United Kingdom, A.Morton@lse.ac.uk, Steve Alpern, Katerina Papadaki

This paper describes a class of patrolling games on graphs, motivated by the problem of patrolling a facility. The facility can be thought of as a graph Q of interconnected nodes and the Attacker can choose to attack any node i of Q within a given time T. He requires m consecutive periods there, uninterrupted by the Patroller, to commit his nefarious act. The Patroller can follow any path on the graph. The Value is the probability that the Patroller successfully intercepts an attack.

3 - A Greedy Algorithm to Assess Vulnerability of Electric Transmission Systems to Intentional Attacks

Sinan Tas, PhD Student, University Wisconsin-Madison, Room3237 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, tas@wisc.edu, Vicki M Bier

A previously developed method for identifying near-optimal interdiction strategies is extended to allow for interdiction of electricity generators and loads as well as arcs, and tested in more realistic systems. The results are compared with random interdiction, and interdiction strategies requiring less information, such as interdiction of the highest-degree nodes.

4 - Network Connectivity Issues for Target Tracking by Cooperating Autonomous Vehicles

Michael Hirsch, Principal Scientist, Raytheon, P.O. Box 10128, M/S: 61, Largo, FL, 33773, United States of America, michael_j_hirsch@raytheon.com, Hector Ortiz-Pena

We study dynamically determining appropriate flight patterns in an urban environment. There are two sets of UAVs. The first set tracks moving targets of interest. The second set maximizes the connectivity of the underlying ad-hoc network, so as to allow the first set of UAVs to share target information across the network. We formulate both UAV problems as mathematical programs. Simulation results show efficient flight formations for both sets of UAVs can be achieved.

■ WC25

C-Room 31A, Upper Level

Lot Sizing II

Contributed Session

Chair: Christian Steffens, University of Cologne, Department for SCM and Production, Cologne, 50923, Germany, christian.steffens@uni-koeln.de

1 - Dynamic Lotsizing When Demand is Stochastic

Sascha Herpers, University of Cologne, Albertus-Magnus-Platz, Cologne, Germany, herpers@wiso.uni-koeln.de

We present a model for dynamic lotsizing when demand is stochastic and a fillrate constraint has to be met. Instances of this model are solved by reformulation as shortest path problem.

2 - Dynamic Multi-machine Lotsizing Models with Jointly Used Setup Resources

Christian Steffens, University of Cologne, Department for SCM and Production, Cologne, 50923, Germany, christian.steffens@uni-koeln.de

In this presentation, we study PLSP-based lotsizing and scheduling models which explicitly include the simultaneous consideration and scheduling of common setup resources. Especially, parallel machines and sequence-dependent setup operations will be introduced. The performance of heuristic solution approaches will be compared to optimal solutions generated using CPLEX. We show that our heuristic is able to generate near-optimal solutions fast, even for real-world-sized cases.

■ WC26

C-Room 31B, Upper Level

Data Envelopment Analysis II

Contributed Session

Chair: Chen-Fu Chien, National Tsing Hua University, 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan - ROC, cfchien@mx.nthu.edu.tw

1 - Evaluating Electricity Efficiency Using the DEA Model

Ramon Posadas, Dr, University of Santo Tomas, Espana St, Manila, 1015, Philippines, ramoncposadas@yahoo.com, Emilyn Cabanda

This paper evaluates the electricity efficiency using the multi-criteria decision-making tool known as the data envelopment analysis (DEA). Our data sample is composed of 118 private electric entities in the Philippines. The proposed DEA model can be a probable new measure for performance evaluation in the current restructuring program of the government towards the efficient electricity services in the countryside.

2 - Using DEA to Assess Efficiency of Provinces in Providing Public Health Care Services

Brian Gozun, Holy Angel University, Sto. Rosario St., Angeles City, Philippines, bcgozun@gmail.com, Rouselle Lavado, Leizel Lagrada

The Department of Health of the Philippines has been adopting local government scorecards to assess the performance of the various provinces. There are too many indicators and there is a need to simplify the indices using DEA. The results will find possible reasons for the bottleneck and will help policymakers prioritize projects.

3 - Using Financial Signature and Data Envelopment Analysis to Benchmark CEO Performance

Thierry Rakotobe-Joel, Ramapo College of New Jersey, Anisfield School of Business, 505 Ramapo Valley Road, Mahwah, NJ, 07430, United States of America, trakotob@ramapo.edu

A benchmarking process of CEOs performance is presented. The approach is based on data envelopment analysis. Data from CEOs salary and their company returns during their tenure are used to build a performance index for a DEA model. Results confirms that CEO's performance can be measured by their decision patterns towards value adding and resource utilization, which is indicated by their financial signature. It also gives insightful information about CEOS ethical and rent generation behavior.

4 - Evaluating Semiconductor Manufacturing Strategies: A Frontier Model Approach

Wen-Chih Chen, National Chiao Tung University, 1001 Ta Hsueh Rd., Hsinchu, Taiwan - ROC, wenchih@faculty.nctu.edu.tw, Chen-Fu Chien

This work aims to evaluate the potential benefits of capacity pooling. We develop a model from the macro viewpoint and conduct an empirical study based on a real case data. The analysis results show that capacity pooling can improve capacity, which is consistent with the findings of earlier works.

■ WC27

C-Room 31C, Upper Level

Advances in Simulation II

Contributed Session

Chair: Byeong-Yun Chang, Assistant Professor, Ajou University, San5, Woncheon-dong, Yeongtong-gu, Suwon, Korea, Republic of, bychang@ajou.ac.kr

1 - A Nonsequential Skewness- and Autoregression-adjusted Batch-means Procedure for Simulation Analysis

Ali Tafazzoli, Metron Aviation, 45300 Catalina Ct. Suite 101, Dulles, VA, 20166, United States of America, ali_tafazzoli@yahoo.com, James R. Wilson

We discuss N-Skart, a nonsequential procedure designed to deliver a confidence interval (CI) for the steady-state mean of a simulation output process when the user supplies a single simulation-generated time series of arbitrary size and specifies the required coverage probability for a CI based on that data set. N-Skart is a variant of the method of batch means that exploits skewness (nonnormality) and autocorrelation adjustments to the half-length of the CI.

2 - An Evaluation of Current Agent-based Modeling Practices and Developing the Conceptual Model for Simulation

Brian Heath, Wright State University, 207 Russ Engineering Center, 3640 Colonel Glenn Hwy, Dayton, OH, 45435, United States of America, heath.19@wright.edu, Frank Ciarallo, Raymond Hill

To advance Agent-Based Modeling (ABM) as an analysis tool, we evaluated the current practices of ABM using a 279 article survey. In this survey we identified several key deficiencies that resulted in the development of a new diagramming technique called the Conceptual Model for Simulation (CM4S) Diagram. The objective of the CM4S Diagram is to bridge the gap between an analyst's conceptual model of the real system and a valid executable simulation of that conceptual model.

3 - Inventory Control of Closed-loop Remanufacturing Supply Chain

Ibrahim Dogan, Wayne State University, Wayne State University, Detroit, MI, United States of America, dogan@wayne.edu, Ratna Babu Chinnam

Most companies have realized that reuse and remanufacturing activities offer opportunities to improve their supply chains by decreasing system-wide costs and improving customer service, besides improving sustainability. However, this is only possible with operational efficiency, especially in inventory management. In this study we provide effective inventory control policies remanufacturing supply chain under non-stationary demand environment.

4 - Estimation Techniques for Nonlinear Functions of the Steady-state Mean in Computer Simulation

Byeong-Yun Chang, Assistant Professor, Ajou University, San5, Woncheon-dong, Yeongtong-gu, Suwon, Korea, Republic of, bychang@ajou.ac.kr, Christos Alexopoulos, David Goldsman

We study point estimators for the value of a nonlinear function of the mean of a stationary stochastic process. The estimators include the corresponding function of the sample mean, an estimator based on nonoverlapping batch means, and a jackknife estimator. We also study estimators for the variance of these point estimators.

■ WC28

H-Room 500, Fifth Floor

Inventory Cost Optimization

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Junmin Shi, Rutgers Business School, 180 University Ave, PhD program in Management, Newark, NJ, 07102, United States of America, jshi@andromeda.rutgers.edu

1 - Optimal Capacity Control for Multiple Medical Diagnostic Facilities

Weifen Zhuang, Nanyang Business School, Nanyang Technological University, Singapore, Singapore, U050023@ntu.edu.sg, Michael Li

Escalating healthcare cost, limited resources, burgeoning demand, and trends toward integration and coordination critically call for an effective and efficient capacity management for expensive medical diagnostic facilities. In this paper, we examine capacity management for multiple diagnostic facilities with three patient segments by studying the underlying stochastic dynamic control problem. This involves two interrelated tasks, namely, outpatient appointment scheduling and dynamic resource allocation. We have fully characterized the optimal dynamic allocation policy as the monotone switching-curve policy for any given appointment scheduling. We propose two scheduling heuristics, namely vertical scheduling and horizontal scheduling, and evaluate their relative performances through numerical studies under different cost and revenue structures. Our multiple-facility model will be relevant and useful in improving utilization of diagnostic facilities, enhancing overall revenue and facilitating resource coordination.

2 - Pricing Perishable Products with Compound Poisson Demands

Yulan Wang, Hong Kong Polytechnic University, Hung Hum, Hong Kong, Hong Kong - PRC, lgtywang@polyu.edu.hk

In this paper, we consider pricing problem in a system with perishable products. The products are produced at a constant rate and potential demands arrive in a compound Poisson process where the batch size has a phase type distribution. Demands are price-sensitive. We carry out the sample path analysis of the inventory process and, by using level-crossing method, we derive the stable distribution of the inventory level given a pricing function and based on that, we express the average revenue function and characterize the pricing strategy given different customers willingness-to-pay function.

3 - Make-to-stock Production-inventory Systems with Continuous Replenishment and Compound Renewal Demand

Junmin Shi, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States of America, jshi@pegasus.rutgers.edu

Consider a continuous-review single-product inventory system with continuous replenishment and compound Poisson demands under the Base-Stock/Backorders/Lost-Sales policy. Inventory depletion is governed by a combination of backorders and lost sales. The system incurs carrying cost and underage cost. The goal is to optimize the expected discounted cost. We derive the expected discounted cost function via a renewal approach. We then derive the optimal minimal-cost solution.

■ WC29

H-Room 501, Fifth Floor

Networks and Pricing

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

Co-Chair: Niko Iliadis, EnerCoRD, Plastira Street 4, Nea Smyrni, Athens, 171 21, Greece, niko.iliadis@enercord.com

1 - Optimal Power Generation Under Routine and Extreme Electric Grid Variability

Brian Adams, Sandia National Laboratories, P.O. Box 5800, MS-1318, Albuquerque, NM, 87185, United States of America, briadam@sandia.gov, Jason Stamp, Bryan Richardson

Domestic productivity and security rely critically on the stability of the electric power grid. Routine performance deviations (due to reliability-based component failure) and unexpected outages (less likely disruptions with greater impact), both affect the grid's ability to meet power demand within operational constraints. This talk will demonstrate large-scale optimization of generation profiles to maximize load served during interruptions, as predicted by steady-state AC power flow models.

2 - Single and Multi-settlement Approaches to Market Clearing Mechanisms under Demand Uncertainty

Javad Khazaei, University of Auckland, Department of Engineering Science, Auckland, New Zealand, j.khazaei@auckland.ac.nz, David Young, Golbon Zakeri

In the presence of uncertainty in demand, there is a need that the market clearing mechanism deals with the deviations between the real and predicted quantities optimally. For this purpose, one or two settlement markets have been suggested in the literature. In this talk, we will discuss a single settlement stochastic programming mechanism and present its characteristics. We then compare this with some currently existing two settlement markets in terms of social welfare at the equilibrium.

3 - Optimizing Natural Gas Supply Portfolios

Kai Helge Becker, London School of Economics and Political Science, Operational Research Group, Houghton Street, London, WC2A 2AE, United Kingdom, k.h.becker@lse.ac.uk

A natural gas supply portfolio is a set of contracts for buying, transporting, storing, and balancing natural gas, which a gas distribution company enters into in order to satisfy customers¥ demands. The paper presents a tool based on several linked linear and mixed-integer programming models that was developed during a consulting project in France and has been used for pricing, strategic analyses of the gas market, and the daily process of managing gas flows.

■ WC30

H-Room 502, Fifth Floor

Investment Decisions in Energy Sector

Contributed Session

Chair: Javier Contreras, Associate Professor, Universidad de Castilla-La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, Spain, Javier.Contreras@uclm.es

1 - Abandonment Decisions in Petroleum Projects, an LSM Simulation Approach

Babak Jafarizadeh, PhD Research Fellow, University of Stavanger, Department of Petroleum Engineering, University of Stavanger, Stavanger, N4036, Norway, babak.jafarizadeh@uis.no

The Least Squares Monte Carlo (LSM) method developed for valuation of financial options appears to be promising for valuation of a large class of real options. In this paper, will apply the LSM method for valuation of an abandonment decision where oil price volatility and uncertain production profile affect the cash flows. The analysis will reveal the option value along with a strategy map on how to achieve this result.

2 - Capacity Generation Expansion Analysis Using Bilevel Programming

Efraim Centeno, Comillas University, Alberto Aguilera 23, Madrid, 28015, Spain, Efraim.Centeno@iit.upcomillas.es, Miguel Vazquez, Alvaro Lopez-Pena

A bilevel model that represents the behavior of a firm faced to the decision of building new plants with a set of different technologies as alternatives is presented. Its main contribution of the model is that market representation (lower level) is made using a conjectured-price-variation focusing with capability for representing different degrees of oligopoly in the market. The upper level uses a single firm net present value as objective function to maximize.

3 - Technology Portfolio and Capacity Investments under Emissions Cost Uncertainty

Tiago Filomena, PhD Student, George Washington University, 1776 G Street, Washington, DC, 20052, United States of America, tiagopf@gwu.edu, Enrique Campos-Nanez, Michael Duffey

We develop a model which helps to understand the impact of emissions policies in electricity generation investment behavior. The model is based on a Nash-Cournot open-loop dynamic optimization and the emissions cost is considered as a stochastic parameter. The model helps to forecast the short-term portfolio of technologies, capacity availability and electricity clearing price for an oligopoly under emissions cost uncertainty. We provide analytical characterization and prove uniqueness.

4 - Optimal Placement and Biding of Distributed Generators in a Competitive Framework

Javier Contreras, Associate Professor, Universidad de Castilla-La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, Spain, Javier.Contreras@uclm.es, Jesus M. Lopez, Jose I. Munoz, Antonio Padilha-Fetrin

A bilevel programming approach for the optimal placement and bidding of distributed generators (DGs) in a competitive environment is presented. The top level optimization problem corresponds to the DG which must decide the placement and bid that would maximize his revenues. The lower optimization level corresponds to the KKT optimality conditions of the problem solved by the distribution utility that attends the expected demand while satisfying network constraints.

■ WC31

H-Room 503, Fifth Floor

Revenue Management and Dynamic Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Wolfgang Ketter, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, wketter@rsm.nl

1 - Using "Last-Minute" Sales for Vertical Differentiation on the Internet

Ori Marom, Assistant Professor, RSM Erasmus University, Burgmeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, omarom@rsm.nl, Abraham Seidmann

We study a model of second degree price discrimination in which a monopolist sells to risk-averse buyers. The seller uses two channels that differ in their risk attributes. In one channel prices and qualities are fixed and availability is assured. In the second channel, the seller offers a joint-distribution of prices and qualities and may not guarantee availability. We characterize optimal two-channel selling policies and discuss implementation issues in recent e-commerce environments.

2 - Adaptive Product Pricing Strategy Differentiation Using Economic Regimes

Alexander Hogenboom, PhD student, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, 287485ah@student.eur.nl, Wolfgang Ketter, Alok Gupta, Jan van Dalen, Uzay Kaymak, John Collins

Product pricing strategies must adapt to market circumstances in order to maximize profits. We dynamically model the relation between observable data and product pricing strategies using economic regimes (characterizing market conditions) and error terms (accounting for customer feedback). In a controlled simulated environment, the novel approach outperforms price-following product pricing.

3 - Revenue and Risk Management on Storage Grids

Sanjukta Smith, Assistant Professor, SUNY Buffalo, 325 Jacobs Management Center, Buffalo, NY, 14260, United States of America, sdsmith4@buffalo.edu, Anna Ye Du, Ram Gopal, Ram Ramesh

We look at the effects of providing a spot market with dynamic prices and forward contracts to evade potential revenue uncertainty of online storage service providers. We obtain revenue-maximizing spot and forward prices for a single seller facing an identified set of buyers, along with a simulation study.

4 - IT Enables Customer-centric Revenue Management: An Empirical Study in A European Transport Market

Ting Li, Assistant Professor, Erasmus University, Burg Oudlaan 50, Rotterdam, 3000DR, Netherlands, tli@rsm.nl, Robert Kauffman, Peter Vervest, Eric van Heck

Recent research suggests a shift to a customer oriented revenue management from commonly used product oriented approach. To date, limited empirical studies have looked at how to achieve this. Working with a European transport firm, we combine two methods to demonstrate the proposed approach. We conduct field experiments to understand customer choice decisions. We develop a simulation to evaluate the impacts of pricing strategies on consumer demand, revenue production, and capacity utilization.

■ WC32

H-Room 504, Fifth Level

Finance and Risk Management II

Contributed Session

Chair: Michael Zabarankin, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States of America, mzabaran@stevens.edu

1 - Beyond Risk Management in Venture Capital: Reversing the Stylized Facts on Options and Portfolios

George Hylden, PhD Candidate, Judge Business School, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, g.hylden@jbs.cam.ac.uk

The research reverses the stylized facts in that it identifies conditions under which: (i) risk may decrease the value of an option and (ii) diversification may decrease the value of a portfolio. The underlying conditions and theoretical findings are consistent with data from venture capital and structured finance during the dotcom bust and the credit crunch. We therefore redefine the limits of conventional risk management and propose novel advances in managing uncertainty and risk.

2 - Research on Catastrophe Risk Disperse Strategy in China

Shuo Liu, International Institute for Applied Systems Analysis, IIASA Schlossplatz 1, Laxenburg, Laxenburg, A-2361, Austria, liushuo@iiasa.ac.at, Liyan Han, Tatiana Ermolieva, Yuri Ermoliev

In this paper, we analyze the Catastrophe risk situation and the issuance problems of CAT bond in China. The limitation and shortage from policy environment, market and the security's characteristics will be discussed. Base on the analysis, an appropriated strategy using CAT Bond to disperse catastrophe risk in China will be proposed. Using our multi-criteria CAT bond pricing model, a case study will be presented and we can see the improvement by the strategy proposed.

3 - Financial Viability of Transportation Infrastructure Public-private Partnerships

S. Reza Seyedshohadaie, Research Assistant, Texas A&M University, 3131 TAMU, College Station, TX, 77840, United States of America, sreza@tamu.edu, Ivan Damnjanovic, Sergiy Butenko

The growing need for transportation infrastructure in countries around the world and public funds limitations has led to involvement of private sector in the provision of transportation infrastructure through "public-private partnerships" (PPPs). In this study, we present a project valuation and risk analysis framework for determining the financial viability of transportation infrastructure PPPs.

4 - Theory and Application of Deviation Measures

Michael Zabarankin, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Department of Mathematical Sciences, Hoboken, NJ, 07030, United States of America, mzabaran@stevens.edu

This talk will survey recent developments in the theory and application of deviation measures that generalize standard deviation and satisfy four axioms: nonnegativity, subadditivity, homogeneity, and invariance to constant translation. Well-known examples of deviation measures are lower semideviation, mean absolute deviation, and CVaR deviation. The applications include maximum entropy principle, Chebyshev and Kolmogorov inequalities, cooperative games, etc.

■ WC34

H-Room 520, Fifth Floor

Transportation and Humanitarian/Societal Impact

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Theresa Barker, PhD Candidate, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@u.washington.edu

1 - Remanufacturing Seeding Under Reusable Random Returns

Ibrahim Karakayali, PhD, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, ibrahimk@ufl.edu, Elif Akcali, Sila Cetinkaya

In this study, we consider a class of remanufacturing seeding problems with reusable random returns. We develop stochastic dynamic models for the purpose of characterizing the optimal seeding, inventory, and production policies. The proposed solution methods rely on dynamic programming and continuous optimization.

2 - Incentive Alignment in Humanitarian Logistics
Alfonso Pedraza Martinez, PhD Student, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, alfonso.pedrazamartinez@insead.edu, Sameer Hasija, Luk Van Wassenhove

We study incentive alignment in humanitarian organizations, focusing on last mile distribution fleet management. Headquarters of these organizations recommend policies to national offices that carry out humanitarian projects. From field research we observe that often these policies are not followed by national offices. Using principal-agent models we show that aligning incentives between headquarters and national offices imposes challenges that are unique to humanitarian operations.

3 - Timely Disaster Response Coordination and Civil Military Cooperation by NATO EADRCC
Metin Ari, Operational Analyst, NATO CC Air Izmir HQ, Command Group, Sirinyer, Izmir, 35548, Turkey, metinari@yahoo.com, Ali Mert, Oykum Esra Yigit, Burcu Ozcam

Timely and Credible response is the key for success in Disaster Response Operations. NATO Euro Atlantic Disaster Response Coordination Center (EADRCC) timely coordination and credible response in several disasters were statistically analyzed and it was shown that in most of the Euro Atlantic Partnership Council (EAPC) Area the Key Performance Indicators of Deployability and Retainability were fulfilled satisfactorily by EADRCC.

■ WC35

H-Sapphire A, Fourth Floor

OR and OM Modeling in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Stefanos Zenios, Stanford University, Graduate School of Business, Stanford, CA, 94305, United States of America, stefzen@GSB.Stanford.Edu

1 - Identifying Good Nursing Levels Given Workload-dependent Absenteeism
Nicos Savva, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nsavva@london.edu, Linda Green, Sergei Savin

Nurse staffing in hospitals is a complex task due to variable patient populations and an often unreliable supply of nurses due to absenteeism. A growing body of evidence indicates that nurse absenteeism is strongly influenced by workload levels and, thus, needs to be treated as an endogenous factor. This talk presents a model to help guide nurse staffing decisions which reflects the impact of workload on nurses' reliability.

2 - Approximate Dynamic Programming Methods for HIV Treatment under Resource Constraints
Andrew Schaefer, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15216, United States of America, schaefer@pitt.edu, Robert Koppenhaver, Mark S. Roberts

Antiretrovirals are be the only treatment for HIV. In areas where HIV is prevalent, they remain to be a scarce resource. Clinics must determine how to best allocate this resource to the patients in need of it. We model this as a large-scale dynamic program and present approximation methods for it. We also consider structured policies and evaluate the performance of them against both the World Health Organization's recommendations and the policies obtained from the approximate dynamic program.

3 - Dynamic Adjustment of Staffing Using Updates in Workload Forecast
Polly He, Stanford University, 518 Memorial Way, Graduate School of Business, Stanford, CA, 94305, United States of America, bhe@stanford.edu, Stefanos Zenios, Franklin Dexter, Alex Macario

Hospital operating rooms often experience uncertain workload that results in overtime and inefficiency. Dynamic adjustment of staffing based on updated forecast can lead to substantial cost saving. We develop a multi-stage dynamic control model to minimize the total labor and adjustment costs. The optimal policy depends on the overage-underage cost ratio, the unit adjustment (upward or downward) cost, and the probability distribution of changes in the demand forecast.

4 - The Effect of Focus on Performance: Evidence From California Hospitals
Diwas KC, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, Diwas_KC@bus.emory.edu, Christian Terwiesch

We estimate the effect of focus on the performance of California Hospitals. Any improved performance could be attributed to either the hospital level process-specific gains associated with focus, or to the specific nature of the patient population. In order to separate the process-specific gains from the customer-specific gains, we use an instrumental variables estimation strategy. We also examine whether an increase in competition following a focused hospital entry impacts incumbent hospitals.

■ WC36

H-Sapphire B, Fourth Floor

Optimization in Radiotherapy IV

Sponsor: Health Applications
Sponsored Session

Chair: Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - Optimal Margin and Edge-enhanced Intensity Maps in Intensity-modulated Radiation Therapy
Timothy Chan, University of Toronto, 5 King's College Road, Toronto, Canada, tcychan@mie.utoronto.ca, John Tsitsiklis, Thomas Bortfeld

We consider radiotherapy treatment planning in the presence of motion and derive optimal solutions for two classes of intensity maps. We also study uncertainty in the parameters of the motion distribution and derive deterministic robust counterparts. We fully characterize the structure of the optimal solutions using constants independent of the problem data. Our results can be used to guide the design of intensity maps that are used in practice to combat motion and motion uncertainty.

2 - A Local Neighborhood Search Algorithm for Optimizing IMRT Beam Angles
Wenhua Cao, Department of Industrial Engineering, University of Houston, 4800 Calhoun Road, Houston, TX, 77204, United States of America, wcao@mail.uh.edu, Gino Lim

We have developed a local neighborhood search method for solving IMRT beam angle optimization problem. The starting feasible solution is obtained by a one-step ahead iterative beam angle elimination algorithm. Two versions of the algorithm are introduced to generate good feasible solutions. Then the proposed local neighborhood search heuristic is used to find a local optimal solution to the problem. Numerical experiments support the potential of this method in practice.

3 - Sequential Linear Programming for Large-scale Dose Optimization
Robert Meyer, Professor Emeritus, University of Wisconsin-Madison, Madison, WI, United States of America, rrm@cs.wisc.edu, Hao Zhang

We present a sequential linear programming method for the solution of large-scale dose optimization problems that arise in intensity-modulated radiation therapy (IMRT). This method makes possible the solution of these very large LPs by decomposing them into sequences of inter-dependent LP subproblems (one LP per beam) of manageable size. Results on difficult clinical test problems are presented.

4 - Volumetric Intensity Modulated Arc Therapy (VMAT) Treatment Planning
Ozan Gozbasi, Georgia Institute of Technology, 2003 Lake Park Dr. Apt. C, Smyrna, GA, 30080, United States of America, ozan@gatech.edu, Eduard Schreibmann, Ian Crocker, Tim Fox, Martin Savelsbergh, Shabbir Ahmed

VMAT is a recent technology in the radiotherapy of cancer patients that makes it possible to deliver a continuous treatment dose during a single rotation of the treatment machine around the patient. The benefits are better patient experience and reduced treatment time. We present MIP-based heuristics to construct VMAT plans and evaluate the results on real patient cases.

■ WC37

H-Sapphire C, Fourth Floor

Transportation in SCM

Contributed Session

Chair: Jingan Li, Assistant Professor, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, No. 55, Zhongguancun East Road, Beijing, 100190, China, ajli@amss.ac.cn

1 - Problems Analysis and Truck Allocation in Sugarcane Transportation: A Case Study in Eastern Thailand
Jirawan Niemsakul, Sripatum University Chonburi Campus, 79 Moo 2 Bangna-Trad Rd., T.Klongtumru, A.Muang, Chonburi, 20000, Thailand, klinsi_07@hotmail.com

Sugarcane transportation problems in the eastern region of Thailand are analyzed to improve the sugarcane delivery planning and truck queuing system. A mix-integer programming model is developed to determine the truck queue and the delivery planning. The objective is to minimize transportation cost in order to

increase the truck efficiency. The model is proposed on a realistic problem. Results show transportation cost and the number of queuing trucks reduction and it can be used effectively.

2 - New Mathematical Formulations for the Scheduling of Inbound Trucks at a Crossdocking Facility

Georgios K.D. Saharidis, Senior Research Associate, Center for Advanced Infrastructure and Transportation, Rutgers - The State University of NJ, 100 Brett Road, Piscataway, NJ, 08854, United States of America, saharidis@gmail.com, Maria Boile, Sotiris Theofanis

A crossdocking facility is one form of a distribution center representing a critical point in the distribution network that if operated efficiently can reduce the transportation costs, increase the consolidation of multiple shipments to full truck loads, and reduce the storage time and the inventory size. Herein two mathematical formulations are presented to schedule inbound trucks to doors at a crossdocking facility, and a solution approach to the resulting problems is presented.

3 - Stochastic Dynamic Programming Models for Shipment Consolidation

Liqing Zhang, Texas A&M University, Department of Industrial and Systems Engr., 3131 TAMU, College Station, TX, 77840, United States of America, liqing@tamu.edu, Sila Cetinkaya

We consider a periodic review, stochastic inventory system for a single item. We examine the optimal outbound dispatch policies for both private fleet and common carrier outbound distribution. We prove the structure of the optimal policy for the former case. We examine the optimality of some practical policies for the latter and provide sufficient conditions under which they are optimal.

4 - Supply Chain Management of an Express Delivery System

Jingan Li, Assistant Professor, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, No. 55, Zhongguancun East Road, Beijing, 100190, China, ajli@amss.ac.cn, Yanhua Li

The e-commerce is becoming more popular, particularly, B2C and C2C. Such e-commerce should always ship small parcels to diversified customers in time, which will demand more efficient express delivery service. Through several express delivery instances, we summarize general characteristics of the supply chain of an express delivery system. And we build models to analyze its performance. Especially, we show how the schedule of carriers and inventory of company facilities affect the supply chain.

■ WC38

H-Sapphire D, Fourth Floor

Optimal Production and Inventory Planning

Cluster: Inventory Management
Invited Session

Chair: Joseph Geunes, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, geunes@ise.ufl.edu

1 - Coordination Mechanisms in a Two-level Supply Chain with Lot-sizing Cost Structures

Wilco van den Heuvel, Erasmus University Rotterdam, Burg. Oudlaan 50, Rotterdam, 3000DR, Netherlands, wvandenheuvel@ese.eur.nl, Edwin Romeijn, Joseph Geunes, Yusen Xia, Xiangtong Qi

We consider a 2-stage supply chain (SC) with a supplier and a retailer. Both stages face fixed order costs and linear procurement and holding costs over a finite horizon. We analyze the use of rebates, wholesale price discounts, and holding cost subsidies for improving SC efficiency in the presence of an uncooperative retailer. We focus on determining the response curve of the retailer. Using an efficiency metric, we evaluate the potential for these mechanisms to achieve operations coordination.

2 - Inventory Pooling and Allocation to Deliver Differentiated Service

Anand Paul, University of Florida, 333 Stuzin Hall, Gainesville, Fl, 32611, United States of America, paulaa@ufl.edu, Aydin Alptekinoglu, Arunava Banerjee

Motivated by our experience in the after-market services industry, we propose a model of pooling with an inventory minimization objective and service level constraints. Our central research question is the following: what are the optimal ordering and allocation policies when a pool of inventory is used to satisfy individual service levels for multiple customers with random demands? We identify optimal policies in several cases.

3 - Procurement Planning with Multiple Case Packs

Shuang Chen, University of Florida, 285 Corry Village Apt 13, Gainesville, FL, 32603, United States of America, scljj@ufl.edu, Joseph Geunes, Ajay Mishra

A case pack is an assortment of varying quantities of SKUs packed together. We study case pack procurement planning problems that address the tradeoff between reduced order handling costs and higher inventory costs. First we exploit properties of optimal solutions with only one type of case pack and solve this model using dynamic programming. For the general model with multiple case packs, which is NP-Hard, we propose an exact decomposition method as well as fast heuristic solution approaches.

■ WC39

H-Sapphire E, Fourth Floor

Advance Selling and Strategic Consumer Behavior

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Mustafa Akan, Assistant Professor of Operations Management, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue Posner Hall 381C, Pittsburgh, PA, 15213, United States of America, akan@cmu.edu

1 - Buy Now and Match Later: The Impact of Posterior Price Matching Policy

Guoming Lai, McCombs School of Business, University of Texas, Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, guomingl@andrew.cmu.edu, Laurens Debo

Consumers may time their purchases for when prices are marked down. This can be so extreme as to severely impact firms' profits. In this study, we investigate a posterior price matching policy, which guarantees a refund to consumers if the seller marks down the price. We reveal when and how much a price matching policy can be beneficial for the seller. We also find that in some environments, a posterior price matching policy can also benefit consumers, which leads to a "win-win" outcome.

2 - Quality Speed Conundrum

Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, M. Fazil Pac, Anand Krishnan

We model a service system where the expected service quality changes with service speed. Increasing the service rate reduces the waiting costs, but also reduces the expected service quality, so slow service might provide better service. An arriving customer decides whether to join a service based on its value, speed of service and his expected waiting costs. We find in equilibrium firms prefer partial market coverage, and charge higher prices in competition.

3 - Advance Purchase Discounts in a Supply Chain

Wenjie Tang, Doctoral Candidate, INSEAD, France, wenjie.tang@insead.edu, Karan Girotra

In this study, we analyze the economics of an advance purchase discount scheme where an upstream tier offers downstream tiers an incentive to place orders well in advance of demand. From observing these advance orders, the upstream tier can infer and utilize the information available to the downstream tier. Such an arrangement leads to efficient risk allocation and productive sharing of information in the supply chain. This leads to Pareto-improving outcomes for all agents.

4 - Revenue Management by Sequential Screening

Mustafa Akan, Assistant Professor of Operations Management, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue Posner Hall 381C, Pittsburgh, PA, 15213, United States of America, akan@cmu.edu, Baris Ata, James Dana

We consider optimal pricing to consumers who are privately informed about both their valuations for the product and when they learn their valuations. Consumers privately learn their valuations over time. Using a mechanism design approach, we show that a menu of expiring refund contracts is optimal. We characterize the optimal menu of refund contracts and identify conditions under which the firm can implement the full information allocation and extract the entire consumer surplus.

■ WC40

H-Sapphire H, Fourth Floor

Retail Operations

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Gurhan Kok, Associate Professor, Duke University, Durham, NC, United States of America, gurhan.kok@duke.edu

1 - Estimating Primary Demand for Substitutable Products From Sales Transaction Data

Gustavo Vulcano, Assistant Professor, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Garrett van Ryzin, Richard Ratliff

We consider an approach for estimating substitute and lost retail demand when only sales transaction data are available and not all products are available in all periods. The problem we consider is how to jointly estimate the parameters of a choice model and arrival rates using only sales transaction data. We develop an efficient algorithm based on estimating "primary" (first-choice) demand and illustrate it on two industry data sets.

2 - Competitive Price-matching Guarantees under Demand Uncertainty and Customer Heterogeneity

Arcan Nalca, Assistant Professor, Queen's School of Business, 143 Union St. Goodes Hall, Kingston, ON, K7L3N6, Canada, arcan.nalca@business.queensu.ca, Tamer Boyaci, Saibal Ray

Under recent form of competitive price-matching guarantees (PMG), a firm matches the lower price of a competitor, conditional upon the availability of the product at the competitor location. We develop a two-stage duopoly model to investigate PMG, price, and inventory decisions as well as verification of availability. We show that offering a PMG allows firms to price discriminate based on price information while verification of inventory allows price discrimination based on availability.

3 - Pricing Leadership and Choice of Pricing Decision Variables in a Multi-member Distribution Channel

Xiaowei Xu, Assistant Professor, Rutgers Business School, 1 Washington Park, Room 958, Newark, NJ, 07102, United States of America, xiaoweix@andromeda.rutgers.edu

This paper studies whether or not pricing leadership benefits channel members and how pricing leadership and the choice of pricing decision variables affect the channel performance. We compare a Stackelberg leadership game with two simultaneous games in absolute margins and percentage margins. We find that if the channel is long, all members prefers no pricing leadership and the simultaneous game in percentage margins is most likely to occur, which results in the best channel performance.

4 - Hierarchical Choice Models, Brand Competition and Properties of Optimal Assortments

Yi Xu, Assistant Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, yxu@rhsmith.umd.edu, Gurhan Kok

We consider a retail category with nonhomogenous products using a hierarchical consumer choice model, namely the Nested Multinomial Logit. Products differ from each other in a key attribute and their brand. We characterize the properties of the optimal assortment for the retailer in the centralized regime and the optimal assortments for each brand in the decentralized regime. We find that the order of the hierarchy in the consumer choice model is critical and leads to significant structural differences in the retailer's assortment.

■ WC41

H-Sapphire L, Fourth Floor

Modeling Mass Egress and Evacuations

Sponsor: Public Programs, Service, and Needs Sponsored Session

Chair: Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

1 - Evacuation Planning Tool (EPT)

Mark Harmon, Manager, SIMLAB, US Secret Service, P.O. Box 50103, Washington, DC, 20223, United States of America, mark.harmon@usss.dhs.gov, Jenish Joseph

Evacuation Planning Tool (EPT) was developed for the Secret Service to examine evacuation strategies from buildings and venues as part of the overall security plans for national, public events. Because security measures may significantly impact location and movement of attendees, an agent-based simulation application was designed to run evacuation scenarios to examine hindrances to flow, plan contingency egress and to estimate total evacuation time.

2 - Agent-based Simulations of Mass Egress: What Next?

Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

We suggest how to address significant challenges in agent-based simulations of mass egress and evacuations: improving the trade-off between detail and speed, incorporating lessons from recent real events and normal crowd movements, assessing the effects of pre-event training and provisioning, dual use of models and depictions in real-time incident management, tracking longer-term effects, and validation.

■ WC42

H-Sapphire P, Fourth Floor

Supply Chain Management II

Contributed Session

Chair: Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48859, United States of America, shaha1s@cmich.edu

1 - A Logistics Scheduling Model with Fixed Procurement Time

Hui Cheng, HKUST, HKUST, Academic Building, 5567#, Hong Kong, Hong Kong - PRC, chust@ust.hk, Xiangtong Qi

In our model,we focus on discussing a single workshop scheduling model with fixed procurement time, in which workshop has to procure raw material from the supplier following the time constraint it offers in a contract. Our objective function is to minimize the total holding cost and setup cost of all jobs. We show that such problems are NP-hard in the strong sense and provide corresponding heuristics, which seem good in numerical experiments.

2 - The Dynamic Demand Game: A Fictitious Play Approach to a Two-echelon Supply Chain Problem

Diana Ramirez, Scientific Director, Centro de Investigacion en Modelacion Empresarial del Caribe, Calle 80 No 42D1 - 30, Barranquilla, dramirez@fcimec.org

We approach a two-echelon supply chain optimization problem, specifically a retailer's replenishment problem, which faces stochastic demand and needs to buy the quantity to its supplier in order to satisfy their demanded quantity and at the same time, minimize costs due to storage and penalty costs. This problem is solved by using learning and evolution techniques, such as fictitious play. The results to a numerical example show improvement over other machine learning techniques.

3 - Optimal Allocation of Carbon Credits in a Multi-phase Cap-and-Trade Market

Ali Diabat, Assistant Professor, MASDAR Institute of Science and Technology, P.O. Box: 54224, Abu Dhabi, United Arab Emirates, adiabat@mist.ac.ae, Tarek Abdallah, David Simchi-Levi

We consider a multi-phase implementation for the Carbon market where capacities imposed on companies decrease each phase and further reduction of emissions becomes harder. We formulate an optimization model to determine the optimal number of credits the government should distribute each phase to minimize the overall credits transferred to consequent phases.

4 - Logistics and Transportation Method

Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48859, United States of America, shaha1s@cmich.edu

Companies may have many plants with varying capacities and cost and could serve multiple markets with varying demand and varying distribution cost based on load and distance. As a result, companies have to decide which plant(s) should serve which market(s) in order to minimize the total cost of production and transportation. Currently, there is no quantitative method to solve this problem. My paper will attempt to find a method which will help solve this problem.

■ WC43

H-Room 400, Fourth Floor

Supply Chain Contract Design under Asymmetric Information

Cluster: Supply Chain Models

Invited Session

Chair: Hao Zhang, Assistant Professor, University of Southern Califonia, Marshall School of Business, Los Angeles, CA, 90089, zhanghao@usc.edu

1 - A Pricing Contract to Reduce Airport Congestion

Georgia Perakis, Professor, Sloan School, MIT, 50 Memorial Drive Building E53-389, Cambridge, MA, United States of America, georgiap@MIT.EDU, Wei Sun

We study a pricing contract for alleviating airport congestion. We consider a model: where passengers travel through the cheapest and fastest way; the airlines compete to maximize their profit and minimize delay; and the FAA maximizes the total social welfare by charging fees to the airlines. We draw a connection with price-only contracts and employ an idea similar to revenue-sharing contacts. We discuss ways to redistribute welfare such that both passengers and airlines could benefit.

2 - A Principal Agent Model for Long-run Performance Contract Using Margin or Volume Incentive

Hongmin Li, Assistant Professor, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, hongmin.li@asu.edu, Charles Fine

We study a performance contract between an OEM and two competing suppliers in a dynamic, uncertain and imperfect-information environment. We provide a principal-agent model for managing suppliers using margin or volume incentives. Our results suggest that in a margin contract, the threat of trapping low-effort low-payoff equilibrium ultimately drives continuous supplier improvement. In contrast, a volume contract relies on asymmetric volume allocation equilibriums to enforce the contract.

3 - The Role of Asymmetric Cost Information in a Finite Repeated Supply Chain Relationship

Deming Zhou, Assistant Professor, Faculty of Business Administration, the Chinese University of Hong Kong, K.K. Leung Building, CUHK, Shatin, NT, Hong Kong - PRC, deming@baf.msmail.cuhk.edu.hk, Justin Ren, Ching Chyi Lee

We consider the procurement contracting in a one-supplier-one-buyer relationship, where the buyer's cost information is private, but they have opportunities to transact repeatedly. We focus on the revelation of the buyer's true information during the repeated interactions without a screening contract. We find that, depending on the parameters, the private information can be revealed in a probabilistic fashion. We discuss further insights in the firms' long-time relationship.

4 - Dynamic Short-term Supplier Contracts under Asymmetric Inventory Information

Hao Zhang, Assistant Professor, University of Southern Califonia, Marshall School of Business, Los Angeles, CA, 90089, zhanghao@usc.edu, Greys Sosic, Mahesh Nagarajan

Inventory information is often privately owned by supply chain members. We study a supplier-retailer supply chain in a dynamic environment. The supplier offers a one-period contract to the retailer in every period but the inventory level and customer demand in each period are only observed by the retailer. We find that when the supplier's production cost and retailer's holding cost are relatively high, the supplier's optimal short-term contracts take the form of batch-order contracts.

■ WC44

H-Room 402, Fourth Floor

Services Factory Modeling

Sponsor: Service Science

Sponsored Session

Chair: Abhijit Bose, Research Scientist, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, bosea@us.ibm.com

1 - A Dynamic Routing Algorithm with Cross-trained Servers, Heterogeneous Demand and Deadlines

Hoda Parvin, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, hoda@umich.edu, Abhijit Bose, Mark Van Oyen, Hyun-soo Ahn

We develop a dynamic routing algorithm for a large-scale service request resolution system. Our routing algorithm incorporates factors such as variability in agents' capabilities, demand heterogeneity and deadlines. We use simulation to evaluate the effectiveness of our proposed routing algorithm using real world data.

2 - Resource Planning Optimization

Shailendra Jain, HP, 1501 Page Mill Road, M/S 1140, Palo Alto, CA, 94304, United States of America, shailendra.jain@hp.com, Richard Spearrin, Maria Gonzalez, Vijay Kumar, Jose Luis Beltran, Ivan Lopez, Jerry Shan

We present a resource planning model to optimize productivity and service experience in a contact center. We show practical issues of a real problem considering technical mobility in a multi-skills environment. By using known results of short term staffing with time varying call volume, we connect the short term staffing problem to the long term resource planning with a joint decision process of hiring and workforce transformation of resources with re-skilling flexibility.

3 - A Method for Joint Capacity Planning and Workflow Scheduling

Assaf Zeevi, Professor, Columbia University, Graduate School of Business, Uris Hall, Room 406, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

We describe a method for jointly optimizing over capacity (required workforce) and the scheduling/routing of work in a simple model of a stochastic processing network. The problem is motivated by global service delivery operations in general, and IBM IT support services in particular, but its core elements apply in broader contexts.

4 - Work Expands to Fill the Time Available: Capacity Estimation and Staffing under Parkinson's Law

Sameer Hasija, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore 138676, Singapore, Sameer.Hasija@insead.edu, Edieal Pinker, Robert Shumsky

We develop a method to estimate the capacity of agents who answer e-mail in a contact center, given aggregate historical data that have been distorted both by constraints on work availability and by internal incentives to slow down when true capacity exceeds demand. We also examine and test models in which agents exhibit speed-up behavior and in which capacity varies over time. Post-implementation results, from an actual contact center, demonstrate that our method provides accurate recommendations.

■ WC45

H-Room 410, Fouth Floor

Innovation Management under Collaboration

Contributed Session

Chair: Villena Martinez, IE Business School, Maria de Molina 12, B 28006, Madrid, Spain, veronica.villena@ie.edu

1 - Mitigating the Disadvantages of Supplier Integration into New Product Development: The Moderating Effect of Modular Design Policy and Project Type

Veronica Villena, vhvillena@gmail.com, Fabrizio Salvador

Based on Suh's(1990) axiomatic design theory,we argue that the drawbacks of supplier integration(SI)on NPD performance can be mitigated by the implementation of a modular design policy(MDP).Using data of 217projects,the results show that MDP increments the benefits associated with SI into NPD performance and such improved benefits are even better when the product belongs to incremental innovation than when it belongs to radical innovation.We draw implications for the literature on concurrent product-process-supply chain design.

2 - Effects of Collaboration Structure on R&D Collaboration Formation and Firms' Resource Sharing

Xiu-Hao Ding, School of Management, Xi'an Jiaotong University, Mailbox 2341#, Xi'an Jiaotong University, Xi'an, 710049, China, dingxiuhao@gmail.com, Rui-Hua Huang

The study differentiates R&D collaboration structure into two forms based on firms' resource investment sequence, and investigates their requirements of collaboration formation and characteristics of firms' resource sharing based on Cournot and Stackelberg models. The cross analysis finds collaboration firms investing resources one by one is more difficult to be formed and produces more transaction costs. Empirical evidence and managerial implications are discussed at the end.

3 - The Dark Side of Social Capital in Collaborative Buyer-Supplier Relationships

Villena Martinez, IE Business School, Maria de Molina 12, B 28006, Madrid, Spain, veronica.villena@ie.edu

Building on social capital and SCM literature,this research examines the positive and negative sides of building social capital in buyer-supplier relationships.The results of a sample of 133 firms indicate that social capital in the form of shared values,trust and information sharing is a productive asset that creates value for firms.However,it might hamper firms'ability to question the status quo,create means for misconduct and reduce chances to access new ideas owing to close social relations.

■ WC46

H-Room 411, Fourth Floor

Design and Brand Management

Sponsor: Technology Management
Sponsored Session

Chair: Tore Kristensen, Professor, Copenhagen Business School, Solbjerg Plads 3, Frederiksberg, DK 2000, Denmark, tk.marktg@cbs.dk

1 - A Strategic Design Management Model for Promoting Brand Building

Jordi Montana, Professor, ESADE Buesiness School, Av. Pedralbes 60 - 62, Barcelona, E-08034 Ba, Spain, jordi.montana@esade.edu, Isa Moll

New ways to promote brand building have been recognized of central importance for companies, as brands have become one of their most valuable assets. Design guided strategically by the brand can serve as a cohesive factor for all elements that take part in the brand experience. 37 top managers of 28 companies acclaimed for their design were interviewed in order to build a model based on design management that promotes brand building strengthening consistent brand experiences.

2 - Quantification of Comprehensive Design Augmented Brand Value

Soren Petersen, Copenhagen Business School, Frederiksberg, Denmark, soren.petersen@ingomar.net

Corporations with strong design and branding outperform the market by approximately 10%, while if only one of these is present; performance drops to 3%. Correctly conceptualizing five designer concept aspects, can significantly influence financial and trend setting performance. This underscores the importance of integrating design into one's business plan.

3 - Classifying Packaging Design Element

Jesper Clement, Copenhagen Business School, Department of Marketing, Frederiksberg, Denmark, JC.marktg@cbs.dk

Consumers make their choice of daily commodities in-store and packaging design can be seen as a matter of getting consumers' visual attention. This paper presents taxonomy for design elements related to visual stimuli, and demonstrates how consumers' eyes actually work in the moment of a purchase decision. The research is based on an eye-track experiment under real conditions in natural environment.

4 - Do Consumer Appreciate Good Design and Are They Also Willing to Pay for It?

Gorm Gabrielsen, Copenhagen Business School, Denmark, gg.mes@cbs.dk, Tore Kristensen

This paper is based on three experiments conducted with each 2 different products; rice paper lamps and mens black shoes. The experiments were conducted in shopping malls where customers were intercepted in natural environments. The experiment based on paired comparisons using a computer based screen in addition to showing the real objects for people to touch, smell, lift.

■ WC47

H-Room 412, Fourth Floor

Marketing II

Contributed Session

Chair: Chihwen Wu, Assistant Professor, National Chung Hsing University, 250 Kuo-Kuang Road, Taichung, Taiwan, Department of Marketing, Taichung, 405, Taiwan - ROC, chihwwu@dragon.nchu.edu.tw

1 - The Impact of Strategic Customer Behavior on Channel Design, Sales and Inventory Strategies

Zhengliang Xue, IBM T.J.Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, zxue@us.ibm.com, Jeannette Song

Consider a retailer selling two vertically differentiated seasonal products through two alternative channels. The prices are visible but the inventory is not. The consumers incur searching costs to visit any channel, purchasing based on the product quality and price as well as the perceived product availability. We study the game between the retailer and two segments of consumers, and show the optimal channel decision depends on the magnitude of searching costs and the distribution of segments.

2 - Optimal Sales Strategy for Durable Goods

Kunpeng Li, Assistant Professor, Sam Houston State University, College of Business Administration, 1821 Avenue I, Huntsville, TX, 77340, United States of America, kli@shsu.edu, Dilip Chhajed

The paper uses self-selection method to investigate obsolescence issues of durable goods in a two-period, two segments market. Obsolescence, consumer's patience level and valuation change, as well as demand substitute properties of durable goods are considered.

3 - A Sample Average Approach to a Maximum Cover Problem

Zhiyuan Dong, PhD Candidate, University of Cincinnati, College of Business, Cincinnati, OH, United States of America, dongzn@email.uc.edu, James Cochran, Martin Levy

In this paper, we apply a sample average approach to a Maximum Cover Problem. We show various large sample properties of this approach, i.e. asymptotic distribution and the almost sure convergence of the optimal objective function value.

4 - Does Early Mover Advantage Exist in Service Industry: Case of Indian Cellular Market

Rajkumar Upadhyay, Doctoral Student, Indian Institute of Management, Bangalore, Bannergatta Road, Bilekahalli, Bangalore, Ka, 560076, India, rajkumaru07@iimb.ernet.in

This paper develops the relationship between early entry and market share using 11 years panel data and finds that early movers have market share advantage. Early mover advantage is seen to increase with the time gap between entries.It is seen to have reduced during the growth phase compared to early adoption stage.Incumbency in fixed line is seen to offset some of the disadvantage of late entry in cellular market. Impact of first mover advantage is found to be lower in high growth markets

5 - Sustainable Development in Tourism Industry Context

Chihwen Wu, Assistant Professor, National Chung Hsing University, 250 Kuo-Kuang Road, Taichung, Taiwan, Department of Marketing, Taichung, 405, Taiwan - ROC, chihwwu@dragon.nchu.edu.tw

The purpose of this research was to develop and test a conceptual framework for sustainable development in tourism industry context to address the integration of social, economic, and ecological elements of sustainable development and the contextual nature of sustainable development. Structural equation modeling using AMOS software platform was used to generate and analyze the hypothesized relationships. The research results will be discussed.

■ WC48

H-Sapphire Green Room, Fourth

Managing Service Variability

Cluster: Service Operations Management
Invited Session

Chair: Sriram Thirumalai, Assistant Professor, Unviersity of Utah, David Eccles School of Business, Salt Lake City, UT, United States of America, sriram.thirumalai@business.utah.edu

1 - Admission Control for Preventive Services

Evrim Didem Gunes, Koc University, Sariyer, Istanbul, Turkey, egunes@ku.edu.tr, Derya Kunduzcu, Mehmet Yasin Ulukus

We consider the capacity rationing of colonoscopy within symptomatic and asymptomatic patients. The system can exercise admission or scheduling or both controls. Scheduling asymptomatic patients is the screening process, improving the status of the whole population in the long run. We consider three different models with different controls. We establish the existence of optimal monotone policies under certain conditions. We study the effects of system parameters through a numerical study.

2 - Managing Outsourced Software Projects: Antecedents of Project Performance and Customer Satisfaction

Sriram Narayanan, Assistant Professor, Michigan State University, N357 Business College Complex, East Lansing, MI, 48824, United States of America, narayanan@bus.msu.edu, Sridhar Balasubramanian, Jay Swaminathan

We study the antecedents of project performance and customer satisfaction in outsourced software projects. We examine how project management, communication and team stability interactively drive performance and customer satisfaction. In particular, we focus on the contingent effects of nature of task and type of software project and duration of the software project.

3 - An Empirical Analysis of the Clinical and Operational Quality of Care in Hospitals

Scott Lindsey, PhD Student, University of Utah - David Eccles School of Business, 1645 E. Campus Drive, Salt Lake City, Ut, 84112, United States of America, scott.lindsey@business.utah.edu, Sriram Thirumalai

This study provides an empirical assessment of the performance implications of the clinical and operational quality of care in hospitals. The empirical analysis in the study is based on data from over 2500 hospitals in the U.S. Implications of the study findings, limitations, and directions for future research are identified.

4 - Health Care Supply Chain for Underserved Communities: Quantity and Quality of Outcomes

Kingshuk Sinha, University of Minnesota, Carlson School of Management, 321-19th Avenue S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, ksinha@umn.edu, Emily Kohnke

This study will examine the effects of the learning process in a supply chain which resulted in a reduction in mortality and the simultaneous increase in the quantity and difficulty of the surgeries performed. The analysis will use a negative binomial model with year controls and account for the difficulty rating of the surgeries performed by applying the RACHS-1 rating system for cardiac surgery difficulty.

■ WC49

H-Room 300, Third Floor

Resource Constrained Project Scheduling

Contributed Session

Chair: Bruce Pollack-Johnson, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States of America, bruce.pollack-johnson@villanova.edu

1 - Algorithms of Robust Resources Allocation for Resource-constrained Project Scheduling Problem

Piotr Lebkowski, Professor, AGH University of Science and Technology, Mickiewicza 30, Krakow, 30-059, Poland, kamienicxka@poczta.fm

In article are presented algorithms of robust resource allocation for resource-constrained project scheduling problem. Effectiveness of algorithms have been tested on the J90 instance set of PSPLIB. As the evaluation criterion proposed by authors measures of robustness of resource allocations were applied.

2 - The Budget Constrained Discrete Time/Cost Trade-off Problem in Project Networks

Guvenc Degirmenci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, gud5@pitt.edu, Meral Azizoglu

In this study we aim to find the minimum cost solution among the optimal solutions of the budget problem. We analyze the structure of the problem together with its linear programming relaxation and derive some mechanisms for reducing the problem size. We find that our branch and bound based optimization algorithm finds optimal solutions for medium-sized problem instances in reasonable times and the approximation algorithms produce high quality solutions in negligible times.

3 - A Decomposition-based Approach for the Stochastic Time-cost Trade-off Project Scheduling Problem

Evelina Klerides, Research Assistant, Imperial College London, Exhibition Road, South Kensington Campus, London, SW72AZ, United Kingdom, e.klerides05@imperial.ac.uk, Eleni Hadjiconstantinou

We address the problem of selecting the most time- or cost-efficient resource allocation for projects under time-cost trade-off settings and uncertain durations. The Stochastic Discrete Time-Cost Trade-off problem uses a stochastic two-stage path-based formulation solved using a decomposition-based exact approach. Extensive computational results show that the proposed algorithm is fast and effective producing solutions of higher quality than those obtained from traditional deterministic models.

4 - Crashing Resource-constrained Projects

Bruce Pollack-Johnson, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States of America, bruce.pollack-johnson@villanova.edu, Matthew Liberatore

The time-cost tradeoff problem ignores resource constraints. Resource-constrained project scheduling does not allow crashing and assumes the total resource usage for a task is fixed. We combine these problems, by allowing each task to be crashed, but recognizing that its total resource usage could then increase due to resource inefficiencies.

■ WC50

H-Room 302, Third Floor

Fairness in Service Systems

Sponsor: MSOM/ Service Management

Sponsored Session

Chair: Mor Armony, New York University, 44 West 4th Street #8-62, New York, NY, 10012, marmony@stern.nyu.edu

1 - Understanding Fairness Using a Queueing Game

Adam Wierman, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, adamw@caltech.edu

The growing trend in computer systems towards using scheduling policies that prioritize jobs with small service requirements has resulted in an increased focus on the fairness of such policies. However, fairness is an amorphous concept and thus difficult to define and study. In this work, we provide a new viewpoint on fairness by considering a queueing game where strategic users have the choice of whether to join the queue.

2 - On the Duality Between Servers and Customers in Large-scale Call Centers

Mor Armony, New York University, 44 West 4th Street #8-62, New York, NY, 10012, marmony@stern.nyu.edu, Amy Ward, Itai Gurvich

In general queueing systems server idle time can be thought of as a server "waiting time" for the assignment of the next customer. In large-scale systems the size of the server pool suggests a potential duality between server idle times and the customer waiting time. We investigate the similarities and differences between the two in a multiskill environment under general skill-based routing rules. Implications on server performance and fairness among servers are also explored.

3 - Fairness of Heterogeneous Queues Through Cone Scheduling

Carri Chan, Stanford University, 260 King St. #545, San Francisco, CA, United States of America, cwchan@stanford.edu, Mor Armony, Nick Bambos

Maximizing throughput for heterogenous queues can be achieved via a general class of cone scheduling algorithms. As the queueing system is stressed, flows with heavy loads tend to monopolize the service resources at the expense of those with lower loads. We explore the asymptotic profile of job backlogs under critical traffic loads controlled by cone scheduling algorithms. Further, we discuss how to tune the scheduling algorithm in order to achieve a target fairness ratio across these backlogs.

4 - Managing Staffing and Control in a Call-Center Co-sourcing Environment

Y. Levent Kocaga, USC Marshall School of Business, 3670 Trousdale Parkway, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, Yasar.Kocaga.2009@marshall.usc.edu, Mor Armony, Amy Ward

Many firms that prefer to keep their call center operations in-house also use outsourcing to manage time periods of overload. In determining the in-house staffing level and the dynamic outsourcing control policy, there is a trade-off between customer abandonment and outsourcing the call at some cost. We propose a near-optimal staffing and control policy that minimizes staffing and outsourcing costs, subject to a constraint on the fraction of customer abandonment.

■ WC51

H-Room 303, Third Floor

Decomposition Methods for Integer Programming I

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)

Sponsored Session

Chair: Matthew Galati, Optimization Interface Lead, SAS Institute, Philadelphia Regional Office, Suite 201, 1400 Morris Drive, Chesterbrook, PA, 19087, United States of America, matthew.galati@sas.com

1 - A Branch-and-price Approach to the Share-of-choice Product Line Design Problem

Xinfang Wang, Assistant Professor, Georgia Southern University, P.O. Box 8151, Department of Finance and Quant, Statesboro, GA, 30460, United States of America, wangfx@email.uc.edu, Jeffrey Camm, David Curry

We develop a branch-and-price algorithm for constructing an optimal product line using partworth estimates from choice-based conjoint analysis. Computational results using large commercial and simulated datasets demonstrate that the algorithm can identify provably optimal solutions to realistically sized problems.

2 - Leveraging Decomposition Techniques for Large-scale Schedule Planning Problems at United Airlines

Rivi Sandhu, Consultant, United Airlines, 1200 E. Algonquin Road, Elk Grove Village, IL, 60007, United States of America, Rivi.Sandhu@united.com, Bala Srinivasan

The Airline Schedule Planning process consists of several large-scale integer problems that are computationally intractable using standard solution techniques. In this talk we present a survey of airline scheduling problems and the decomposition techniques used at United to solve such problems. We discuss solution approaches including benders, sub-gradient, branch & price. We provide computational results that illustrate the usefulness of these techniques.

3 - DECOMP: A Framework for Decomposition in Integer Programming

Matthew Galati, Optimization Interface Lead, SAS Institute, Philadelphia Regional Office, Suite 201, 1400 Morris Drive, Chesterbrook, PA, 19087, United States of America, matthew.galati@sas.com, Ted Ralphs

Decomposition techniques such as Lagrangian Relaxation and Dantzig-Wolfe decomposition are well-known methods of developing bounds for discrete optimization problems. We draw connections between these classical approaches and techniques based on dynamic cut generation. We discuss methods for integrating cut generation and decomposition in a number of different contexts and present DECOMP, an open-source framework that provides a uniform interface for implementation of these various techniques.

■ WC52

H-Room 304, Third Floor

Economic Models in Supply Chains

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Yunzeng Wang, Dr., University of California Riverside, 900 University Avenue, Riverside, CA, United States of America, yunzeng.wang@ucr.edu

1 - Name-your-own-price as a Competitive Distribution Channel in Presence of Posted Prices

Xiao Huang, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, xiao.huang.2009@marshall.usc.edu, Greys Sosic

We consider two competing wholesalers with fixed inventories, one intermediary firm, and a sequence of customers. A customer can either buy directly from a wholesaler at the posted price, or name her own price with the intermediary firm. If the price is accepted, either product may be assigned to the customer; otherwise, the customer can still buy from one of the wholesalers or leave without purchase. We study the channel strategy for the customers and the pricing strategy of the wholesalers.

2 - Optimal Component Procurement Strategy in Assemble-to-order Systems with Demand Forecast Updates

Rick So, Professor, UCI, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, rso@uci.edu, Chung-Yee Lee, James Cao

We examine the value of demand forecast updating for an assemble-to-order manufacturer who faces a single customized order for its product. The manufacturer needs to procure multiple components from independent suppliers with different lead times. The manufacturer must decide on the best quantities to order for each component using a noisy forecast. We develop an analytical model to obtain the optimal profit and component procurement strategies and show high returns for a forecasting firm.

3 - Consignment Contracting: Who Should Control Inventory in the Supply Chain?

Jun Ru, PhD Candidate, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, jun.ru@utdallas.edu, Yunzeng Wang

Consignment is a popular form of business arrangement where supplier retains ownership of the inventory and gets paid from the retailer based on actual units sold. The popularity of such an arrangement has come with some continued debates on who should control the supply chain inventory, the supplier or retailer. Our results indicate that it is beneficial both to the supplier and to the retailer when delegating the inventory decision to the supplier rather than to the retailer.

4 - The Effects of Decision Sequence on Supplier Competition in Decentralized Assembly System

Li Jiang, Assistant Professor, Hong Kong Polytechnic University, CF 721 LMS Department, Hung Hom, Hong Kong - PRC, L.Jiang@inet.polyu.edu.hk, Yunzeng Wang

We consider an assembler who assembles a final product by use of n components. The supplier for each component faces competition from other suppliers who provide identical or completely substitutable items. Wholesale price contract binds the assembler to each component supplier. We characterize the equilibrium of the decentralized assembly system where suppliers sequentially make wholesale price decisions, and compare to when suppliers simultaneously select wholesale prices.

■ WC53

H-Room 305, Third Floor

Advances in Integer Programming

Contributed Session

Chair: Yuri Smirnov, Xpress eXpert, FICO, 181 Metro Dr., Suite 600, San Jose, CA, 95110, United States of America, yurismirnov@fico.com

1 - Multi-objective Integer Programming: A General Approach for Generating all Nondominated Solutions

Melih Ozlen, RMIT University, GPO Box 2476V, Melbourne, 3001, Australia, melih.ozlen@rmit.edu.au, Meral Azizoglu

In this study we develop a general approach to generate all nondominated solutions of the Multi-Objective Integer Programming (MOIP) problem. Our approach, which is based on the identification of objective efficiency ranges, is an improvement over classical Œμ-constraint method. Objective efficiency ranges are identified by solving simpler MOIP problems with fewer objectives. We present our method on Tri-Objective Integer Programming problem and then extend it to the general MOIP problem.

2 - Modeling Connected Components in MIP

Yuri Smirnov, Xpress eXpert, FICO, 181 Metro Dr., Suite 600, San Jose, CA, 95110, United States of America, yurismirnov@fico.com, Alkis Vazacopoulos

When designing certain complex systems Mixed-Integer Programming (MIP) is the most appropriate modeling choice. However, some modeling paradigms are challenging for the MIP framework. Connected subgraphs is one such. We demonstrate the motivation and suggest a number of formulations that include separate necessary and sufficient conditions of the subgraph connectivity.

3 - Integer Linear Programming Problems of Special 0 or 1 Matrices

Vladimir Tsurkov, Head of Department, Dorodnitsyn Computing Centre of the Russian Academy of Sciences, Vavilova, 40, Moscow, 119333, Russia, tsur@ccas.ru, Alexander Tizik

A net optimization large scale problem from telecommunication area is solved by means of the known method of column generation. The intermediate problems of the algorithm have special matrices of 0 or 1 elements. In some cases the simplex method leads to integer solution. In other cases an algorithm of polinomial complexity is proposed. Main constructions of this method are applied to various transportation problems.

4 - Minimal Subadditive Characterization of Facets

Sangho Shim, Georgia Tech ISyE, 765 Ferst Dr NW, Atlanta, GA, 30332-0205, United States of America, shim@gatech.edu, Ellis Johnson

A knapsack problem may be relaxed to a cyclic group problem. Gomory found the subadditive characterization of facets of the master cyclic group problem. We simplify the subadditive relations by the substitution of complementarities and discover a minimal representation of the subadditive polytope.

5 - Solution Strategies for Hard MIP Problems

Richard Laundy, Principal, FICO, Leam House, 64 Trinity Street, Leamington Spa, CV32 5YN, United Kingdom, richardlaundy@fico.com, Yuri Smirnov, Alkis Vazacopoulos

In this talk we describe strategies for solving hard MIP problems. We show how problems which seem intractable can be solved by using different techniques. Good strategies for one class of problem may not work on other problem classes and choosing the best strategy is often the key to solving hard MIPs.

■ WC54

H-Room 306A, Third Floor

Network Design and Algorithms

Sponsor: Optimization/Networks
Sponsored Session

Chair: Mohammad Taghi Hajiaghayi, AT&T Labs - Research, 180 Park Ave, Florham Park, United States of America, hajiagha@mit.edu

1 - Improved Approximation Algorithms for Prize-collecting Steiner Tree and TSP

Hossein Bateni, Princeton University, 35 Olden Street, Princeton, NJ, 08540, United States of America, bateni@gmail.com

We study the prize-collecting Steiner tree (PCST) and traveling salesman (PCTSP) problems: given a weighted graph with a penalty on each node, the goal is to find a tree (for PCST) or cycle (for PCTSP), that minimizes the sum of the edge costs in the tree/cycle and the penalties of the nodes not spanned by it. We

improve the approximation ratio to a constant below two—-the best previously known result (GW92) was a 2-approximation and is tight up to the integrality gap. (joint work)

2 - Approximation Algorithms Guarantees Independent of the Graph Size

Ankur Moitra, MIT, 70 Pacific St, APT 346 A, Cambridge, MA, United States of America, moitra@MIT.EDU

Here we are interested in the meta question: Suppose we are given a poly(log n) approximation algorithm for a multicommodity-type problem - when can we give a poly(log k) when there are only k "interesting" nodes? We require that these approximation guarantees be independent of the size of the graph. For many natural applications, such guarantees are much stronger. Our approach yields poly(log k) approximation algorithms for a number of problems for which such results were previously unknown.

3 - Local Search Algorithms for Generalized K-median Problems

Rohit Khandekar, Research Staff Member, IBM T.J.Watson Research Center, 19 Skyline Drive, Elmsford, NY 10532, rkhandekar@gmail.com, Mohammad Taghi Hajiaghayi, Guy Kortsarz

I shall present some recent development on designing local-search based approximation algorithms for generalized k-median problems.

■ WC55

H-Room 306B, Third Floor

Vehicle Routing II

Contributed Session

Chair: Weiwei Chen, Student, University of Wisconsin-Madison, 3247 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, wchen26@wisc.edu

1 - Vehicle Routing Problems: Does GIS Add Value?

Hindupur Ramakrishna, Associate Professor, University of Redlands, School of Business, 1200 E. Colton Avenue, Redlands, CA, 92373, United States of America, hindupur_ramakrishna@redlands.edu, Avijit Sarkar

The last ten years have witnessed a substantial growth in the use of Geographic Information Systems (GIS) towards the solution of vehicle routing problems (VRP). However the benefits of GIS application have not been systematically cataloged. This study investigates prior research on the VRP and its variants, explicitly identifies the value addition in routing due to the combination of GIS with OR/MS derived algorithms and outlines the scope of GIS infusion in unexplored areas of vehicle routing.

2 - Vehicle Routing under Time-dependent Travel Times: The Impact of Congestion Avoidance

Marco Schutten, University of Twente, Fac. MB / OMPL, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.schutten@utwente.nl, Erwin Hans, Leendert Kok

Daily traffic congestions form major problems for businesses such as distribution firms. The costs of traffic congestions can be reduced by accounting for well-predictable congestions within the vehicle route plans. We investigate the impact of congestion avoidance strategies on the performance of these plans. Computational experiments show that 99% of late arrivals can be eliminated and that almost 70% of the extra duty times caused by traffic congestions can be eliminated by clever strategies.

3 - Local Pickup and Delivery Problem with Stochastic Loads

Weiwei Chen, Student, University of Wisconsin-Madison, 3247 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, wchen26@wisc.edu, Liang Pi, Leyuan Shi

Local Pickup and Delivery Problem (LPDP) is a key problem in trucking industry. While most previous studies focus on the deterministic problem, in applications, there are some loads occurring with probability during the operation. The mathematical models for this stochastic LPDP are introduced. When maximizing expected profit, stochastic LPDP has a similar formulation as its deterministic counterpart. A hybrid nested partitions and math programming approach is used to solve the problem.

■ WC56

H-Room 307, Third Floor

Pricing and Revenue Management II

Contributed Session

Chair: Leo MacDonald, Coles College of Business, KSU, 1000 Chastain Rd, Kennesaw, GA, 30144, United States of America, lmacdon4@kennesaw.edu

1 - The Newsvendor Problem with Pricing; Multiple Price-quantity Pairs Solutions

Craig Sorochuk, Richard Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, ON, N6A 1Y2, Canada, csorochuk@ivey.ca, John Wilson

We provide an alternative approach to addressing the newsvendor problem where price is a decision variable as well as inventory level. Using this alternative model, we show when a single price-quantity pair solution should be used to maximize expected profit, as well as when multiple price-quantity pair solutions are appropriate. Numerical examples are also given.

2 - Markdown Optimization with Sell Through Target above Pricing Level

Xiaodong Yao, SAS Institute Inc., SAS Campus Drive, Cary, 27519, United States of America, xiaodong.yao@sas.com, Tugrul Sanli

One of the biggest business problems retails face is how to liquidate inventory as profitably as possible while following a number of business rules and constraints. One of the constraints is sell through target, which is usually specified at a higher level than the markdown pricing level. This complicates the markdown optimization problem significantly since product/location groups can no longer be priced independently. We develop a two-stage decomposition approach to solving the problem.

3 - The Interplay of List Price and Discount Optimization

Aihong Wen, PROS Revenue Management, 3100 Main St.Suite 900, Houston, United States of America, awen@prosrm.com

It is common for distribution industry to offer discounts off list prices according to order amount and/or other factors. Similar situation exists in other industries such as health care when they negotiate contract terms with insurance companies. We study the interaction between list price and discount optimization. Our results show the integration of these two pricing components brings higher value to business.

4 - Exploring Price Guidance Strategies with Simulation Analysis

Maarten Oosten, PROS, 3100 Main Street Suite 900, Houston, TX, 77002, United States of America, moosten@prospricing.com, Faruk Sengul

Pricing methods based on Price Guidance & Segmentation have been a great success in the market for pricing applications, especially in the distribution and manufacturing industries. These strategies appear intuitive and the first experiences in the market are positive. What are good, sound guidance strategies? We are taking on this challenging question by building a simulation environment to test how various methods are doing in different scenarios.

5 - Revenue Management of Ancillary Revenues

Leo MacDonald, Coles College of Business, KSU, 1000 Chastain Rd, Kennesaw, GA, 30144, United States of America, lmacdon4@kennesaw.edu, Govind Hariharan

Traditionally, service sector revenue management has been concerned with optimizing of price/booking-limits. However, ancillary revenue streams can contribute significantly to the profitability of the service provider, for example discount airlines such as RyanAir have reported large gains from ancillary revenues. The focus of this research is the presentation and evaluation of modeling approaches within the airline sector for the optimization of ancillary revenue streams.

■ WC57

H-Room 308, Third Floor

Game Theoretic Applications in Healthcare II

Sponsor: Health Applications
Sponsored Session

Chair: Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, endmuratkurt@yahoo.com

1 - A Game-theoretic Framework for Estimating the Willingness-to-Pay for Health and for Expansion

Reza Yaesoubi, PhD Candidate, North Carolina State University, Campus Box 7906, 421 Daniels Hall, Raleigh, NC, 27511, United States of America, ryaesou@ncsu.edu, Stephen Roberts

We propose a game-theoretic framework for estimating the willingness-to-pay (WTP) for health in markets where the health purchaser offers a menu of medical interventions, and each individual selects the intervention that maximizes her utility. The framework also introduces a measure for estimating the WTP for expanding the utilization of medical interventions. The numerical results from applying the framework to Colorectal Cancer screening tests will be presented.

2 - Efficient Characterization of Welfare Maximizing Equilibria in Prearranged Paired Kidney Exchanges

Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Mark S. Roberts, Andrew Schaefer, M. Utku Unver

We consider a non-zero sum stochastic game formulation to model the transplant timing decisions in a prearranged paired kidney exchange. For an efficient characterization of welfare maximizing equilibria of the underlying stochastic game, we propose exact and approximate procedures based on auxiliary single-controller MDP models and an optimal solution of an MIP formulation involving a partial relaxation of the equilibrium constraints.

3 - Decentralized Resource Allocation to Control an Epidemic: A Game Theoretic Approach

Shouqiang Wang, PhD Candidate, Fuqua School of Business, Duke University, 1 Towerview Dr., Durham, NC, 27705, United States of America, sw55@duke.edu, Peng Sun, Francis de Vericourt

This paper examines how two countries would allocate resources at the onset of an epidemic when they seek to protect their own populations. We model this situation as a game between selfish countries, where players strategically allocate their resources in order to minimize the total number of infected individuals in their respective populations during the epidemic. We also consider possible extensions.

■ WC58

H-Room 309, Third Floor

Scheduling and Timetabling

Contributed Session

Chair: Dilay Celebi, Istanbul Technical University, Macka 34367, Istanbul, Turkey, celebid@itu.edu.tr

1 - Scheduling Gifted and Talented Education Classes

Rachel Townsley, Undergraduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rtownsle@uark.edu, Scott Mason

We examine Gifted and Talented (GT) education program scheduling. GT students, who have exceptional analytical and creative abilities, are pulled out of their regular classes and activities twice each week to attend a 1-2 hour enrichment class with other GT students in their same grade level. We present a methodology for scheduling GT class meetings for each grade, subject to student availability constraints due to lunch, recess, and other non-classroom activities.

2 - Development of a School Timetable Generating System by a General RCPSP Scheduler

Masanori Horio, PhD, Nagoya University of Arts and Sciences, Iwasaki-cho,Takenoyama-57, Nisshin, 4700196, Japan, horio@nuas.ac.jp, Atsuo SUZUKI

We have developed a school timetable generating system for Nagoya University of Art and Sciences. The system has the following features. - Using the system, anyone can obtain a feasible timetable by an easy operation. - Since some practical functions were added according to administrator's advises, the labor time for generating the timetable has been reduced greatly - The system has been constructed in a short period of time and at low cost by some devices.

3 - Performance Tuning an Integer Program Model for United States Postal Service (USPS) Test Mail Induct

Mariah Jeffery, Managing Consultant, IBM Global Business Services, 15450 SW Knoll Parkway, Beaverton, OR, 97006, United States of America, mjeffery@us.ibm.com, Hua Ni, Noriah din Daily

IBM contracts with the USPS to report its on-time performance to service standards by creating and tracking test mail. We discuss the integer programming model used for developing mail induction schedules. We discuss the problem structure, and how we reduced the model's runtime by more than 90 percent via performance tuning.

4 - Maintenance Scheduling for Light-rail Vehicles

Dilay Celebi, Istanbul Technical University, Macka 34367, Istanbul, Turkey, celebid@itu.edu.tr

For a reliable light rail system, vehicles should be maintained at predetermined points, defined by either time or distance intervals. The objective of this study is to provide a mathematical programming model that can serve as a basis for maintenance scheduling problems. The model covers both maintenance costs and safety considerations, and gives an optimal maintenance schedule for a finite time horizon. A real life application is also presented to demonstrate the functionality of the model.

■ WC59

H-Room 310, Third Floor

Tutorial: Recent Advances in Nonlinear Programming

Cluster: Tutorials
Invited Session

Chair: Leon Lasdon, University of Texas, lasdon@mail.utexas.edu

1 - Recent Advances in Nonlinear Programming

Leon Lasdon, University of Texas, lasdon@mail.utexas.edu

We discuss the state of the art in NLP algorithms and modeling systems, covering GRG, SQP, and Interior Point methods, and both algebraic modeling languages and spreadsheet optimization. We review recent enhancements to GAMS and the Risk Solver Platform 9.5 from Frontline Systems. Applications to waterflooding oil fields are described.

■ WC60

H-Room 311, Third Floor

Stochastic Optimization II

Contributed Session

Chair: Medha Dhurandhar, Head & Program Coordinator, Centre for Development of Advanced Computing, Pune University Campus, Ganeshkhind Rd., Pune, 411007, India, mdhurandhar@gmail.com

1 - Pattern Discrete and Mixed Hit-and-run for Global Optimization and Mixed Integer Programming

Huseyin Mete, PhD Candidate / Research Assistant, University of Washington, Industrial and Systems Engineering, Box 352650, Seattle, WA, 98195-2650, United States of America, mete@u.washington.edu, Zelda Zabinsky

We develop Markov chain Monte Carlo samplers for neighborhood generation in global optimization based on Hit-and-Run. We define Sphere and Box Biwalks that are pattern based and easily implemented for discrete and mixed domains bounded by linear constraints. The Markov chains converge to a target distribution over sets in a polytope. We derive performance bounds on mixing time for special cases that are polynomial in dimension. We discuss impact to Improving Hit-and-Run for special cases of MIP.

2 - Semidefinite Programming under Uncertainty

Yuntao Zhu, Arizona State University, P.O. Box 37100, Phoenix, AZ, 85069-7100, United States of America, yuntao.zhu@asu.edu, K. A. Ariyawansa

In this talk we introduce a new optimization paradigm termed Stochastic Semidefinite Programming (SSDP) for dealing with uncertain data in applications leading to semidefinite programs. The formulation of SSDP is stressed as well as applications and solving algorithms.

3 - The Distribution Problem for Stochastic Linear Programming

Sara Nourazari, PhD Student, University of Oklahoma, 202 W. Boyd, Rm 124, Norman, OK, 73019, United States of America, sara.n@ou.edu, Hillel Kumin

Numerical results for the distribution problem for stochastic linear programming problem are very difficult to obtain. Using a Jacobian transformation we obtain a new closed form expression for the cumulative distribution function (CDF) of the maximum value of the objective function in a stochastic linear programming problem in the case where either the objective function coefficients or the right-hand side coefficients are given by known probability distributions.

4 - Efficient Algorithm Constructing Minimum Path Factors of Digraphs Minimizing Operational Cost

Medha Dhurandhar, Head & Program Coordinator, Centre for Development of Advanced Computing, Pune University Campus, Ganeshkhind Rd., Pune, 411007, India, mdhurandhar@gmail.com

We present an efficient algorithm constructing all minimum path factors of acyclic digraphs modeling real world problems. This involves generation of pseudo-bipartite subdigraphs & edge-contraction along maximum matching in the subdigraphs. This methodology gives flexible, pragmatic solutions under realistic constraints for a wide variety of Industrial applications like optimal resource scheduling for Project Management, Logistics/Transport industry, Assembly line processing in Manufacturing.

■ WC61

H-Room 312, Third Floor

Evacuation Planning

Contributed Session

Chair: Ashwin Arulselvan, University of Florida, 303 Weil Hall P. O. Box 116595, Gainesville, FL, 32611, United States of America, ashwin@ufl.edu

1 - Best-response Model for Evacuees' Exit Selection

Simo Heliovaara, Helsinki University of Technology, Otakaari 1 M, Espoo, Finland, simo.heliovaara@tkk.fi, Harri Ehtamo, Timo Korhonen, Simo Hostikka

A model for evacuees' exit selection in emergency evacuations is presented. The game theoretic concept of best response dynamics is used to model the interaction between evacuees. We present a mathematical formulation for the model, show that the game has a Nash equilibrium with pure strategies, and analyze different iterative methods for finding it. Results of numerical simulations are shown and the applicability of the model is discussed.

2 - A Secure and Efficient Emergency Management System for Disasters

Eren Ozguven, Graduate Assistant, Rutgers University/Civil and Environmental Engineering, 623 Bowser Road, Piscataway, NJ, 08854, United States of America, ozguvene@rci.rutgers.edu, Kaan Ozbay

A careful planning and inventory management policy is a must for during and/or after disaster conditions. To have a robust system, off-line planning and on-line real-time management of emergency operations should be employed. We first present the overall methodology. Then, we model the off-line inventory management problem as a Hungarian Inventory Control Model followed by a numerical example solved using the pLEPs algorithm.

3 - An Optimization Approach for Hurricane Evacuation Using a Fixed Flow Rate

Shabnam Zangeneh, University of Houston, Department of Industrial Engineering, Houston, TX, 77204, United States of America, szangeneh6@uh.edu, Gino Lim, Mohammad Reza Baharnemati

An important characteristic in the hurricane evacuation models is the fixed rate of outgoing flow from impact areas to safe areas, because in the practical point of view, it is much easier to manage a fixed rate of evacuees rather than variable amount of flow in each time period. In this paper, we address the problem of maximizing the total number of evacuees which are using the optimized evacuation path and schedule in a fixed-rate pattern.

4 - System Optimal Dynamic Traffic Assignment Formulation with Probabilistic Capacity Constraints

Anil Yazici, Research Assistant, Rutgers University, Department of Civil & Environmental Engineering, 623 Bowser Road, Piscataway, NJ, 08854, United States of America, yazici@eden.rutgers.edu, Kaan Ozbay

The study provides a stochastic programming approach to cell transmission based system optimal dynamic traffic assignment via assuming random link capacities. The formulation is provided along with proposed solution methodologies. Two random link capacity case studies are also presented, namely traffic fluctuations based on daily events such as incidents, and evacuation conditions in which the random capacities are imposed by the nature of the threat.

5 - Branch and Price Mechanism for Multimodal Evacuation Problems

Ashwin Arulselvan, University of Florida, 303 Weil Hall P. O. Box 116595, Gainesville, FL, 32611, United States of America, ashwin@ufl.edu

We propose a branch and price technique to solve a bimodal evacuation problem, where in the evacuees use cars and buses as modes of evacuation. We also study some stabilization techniques to accelerate the convergence and compare their performance.

■ WC62

H-Room 313, Third Floor

Organization Theory II

Contributed Session

Chair: Terrill Frantz, Carnegie Mellon University, 5000 Forbes Ave, SCS/ISR, Pittsburgh, PA, 15312, United States of America, terrill@cs.cmu.edu

1 - Theory of Mixed Enterprises

Victor Chen, Simon Fraser University, 4120 Kaslo Street, Vancouver, Canada, zca4@sfu.ca

Mixed enterprises refer to enterprises which have both government equity and private equity. I propose to develop a theoretical framework to study performance of mixed ownership based on its costs and benefits in different environments.

2 - Information System Infrastructure and Requisite Integration as Moderators of Task Exceptions

Antti Tenhiala, Helsinki University of Technology, Otaniementie 17, Espoo, 02150, Finland, antti.tenhiala@hut.fi, M. Johnny Rungtusanatham

Task exceptions in production processes deteriorate delivery performance unless they are appropriately absorbed or mitigated. The absorption capacity of a process depends on its requisite integration while the mitigation capability depends on its information system infrastructure. This study shows that the absorption capacity and the mitigation capability are related because processes with different levels of requisite integration require completely different information system infrastructures.

3 - The Impact of Network Structure and Network Content on Knowledge Process and Team Performance

Hua Zhang, School of Management Xi'an Jiaotong University, Mailbox 2308, Xi'an, 710049, China, zhang_hua@live.cn, Cunying Chen, You Min Xi

Previous social network literature paid much attention on network structure but largely ignored network content variable. This study adds the network content varialbe to the simulation model on parallel problem solving. Particularly we provide further insight into agent's imitation strategy to explore how the interaction of network structure and agent imitation strategy affects the knowledge process and finally affects team performance.

4 - Exploring Knowledge and Cultural Transfer Following an Organizational Merger

Terrill Frantz, Carnegie Mellon University, ISR/SCS 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, terrill@org-sim.com, Kathleen Carley

We use a multi-agent model of social interaction and information exchange: Construct embodies computational organization theory, behavioral psychology, social network theory, network analysis, and traditional organization behavior and management theory. We manipulated conditions such as team structure, task-interdependency, and the level of knowledge to identify the impact on congruence over time. Results indicate these factors affect the conformity rates during the integration stage.

■ WC63

H-Room 314, Third Floor

Health Care Strategy II

Contributed Session

Chair: Steven Cohen, Director, Center for Financing, Access and Cost Trends, Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD, 20850, United States of America, scohen@ahrq.gov

1 - An Operational Ecology Model for Enhancing the Sustainability of the US Health Care Industry

Namkyu Park, Associate Professor, Ohio University, Department of Industrial & Systems Engineerin, Athens, OH, 45701, United States of America, parkn@ohio.edu, Olusola Oduntan

The Operational Ecology Model, a management framework for the analysis and design of sustainable enterprises, is used to diagnose the current issues affecting the US health care industry. Different policy options for resolving the health care crisis are analyzed, and the benefits and drawbacks of each option are revealed.

2 - Impact of Social and Behavioral Issues on Pandemic Influenza Containment

Dayna Martinez, Research Assistant, University of South Florida, Department of Industrial Engineering, 4202 E. Fowler Avenue ENB 118, Tampa, FL, 33620, United States of America, dlmartin@mail.usf.edu, Tapas Das, Alex Savachkin

Little attention has been directed to identifying social factors likely to influence human behavior during a pandemic influenza. These factors are of particular importance since human behavior play a major role in the spread of a pandemic and the success of any mitigation strategy. In this research, the interplay of social, psychological and behavioral factors with the containment and mitigation strategies are examined via an existing simulation-based optimization model for pandemic influenza.

3 - Modeling and Microsimulation Infrastructure to Support Healthcare Policy Initiatives

Steven Cohen, Director, Center for Financing, Access and Cost Trends, Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD, 20850, United States of America, scohen@ahrq.gov

Policymakers often depend on model-based estimates of the "future state" under demographic, economic and technological assumptions subject to high levels of uncertainty. Such modeling efforts project health care expenditures and utilization, estimate the impact of changes in financing, coverage, and reimbursement, and determine the impact of changes in policy. This presentation focuses on related issues of data capacity and statistical quality, with examples from the MEPS.

■ WC64

H-Room 202A, Second Floor

Internet Applications

Contributed Session

Chair: Harry Ma, Statistician, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, mah@research.ge.com

1 - When to Start the Internet Business

Yongma Moon, Pennsylvania State University, 240 Leonhard Blg, University Park, PA, 16802, United States of America, yongma@psu.edu, Tao Yao

The most crucial question in a service area is whether to construct an Internet channel in addition to a traditional retail channel under uncertainty. However, little attention has been paid to when to develop the Internet channel. Thus, this paper proposes a model to help a firm to determine the timing using a real option theory. Based on the proposed model, we study the impacts of cost uncertainty and customer's behavior on a timing strategy.

2 - A Growth Model Research of E-commerce Market: An Empirical Investigation in China

Lisha Liu, Beihang University, 2-713B, Beijing, 100191, China, lisa.buaa@gmail.com

In this article, we explored the impact of the growth of e-commerce market based on the theory of economic growth, and analyzed both B2B and B2C e-commerce marketing in one model to compare the difference factors between them. The factors we identified are investment in ICTs, network infrastructure, globalization, urbanization and internet users. The data is collected from 2001 to 2007 in China. We use multiple linear regression methods and most of the results are in line with our assumptions.

3 - End-to-end Bandwidth Guaranteed Services: Profit Maximization and Risk Management

Praveen Kumar, RPI, 110 8th Street, Troy, NY, 12180, United States of America, muthup@rpi.edu, Aparna Gupta

We consider an ISP's problem of providing end-to-end (e2e) bandwidth services. A path-vector based approach is employed, in which an ISP uses its edge-to-edge single-domain contracts and the vector of contracts purchased from neighboring ISPs as the building blocks to construct e2e contract paths. We consider stochastic demand and contracting costs to develop optimal contracting strategy to create e2e service that maximizes the ISP's profits while managing the risks.

4 - Sampling Ego Networks for Viral Marketing

Harry Ma, Statistician, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, mah@research.ge.com, Steven Gustafson, Abha Moitra, David Bracewell

Online viral marketing is regarded as one of the most effective marketing tools. Measuring the network of websites spreading marketing messages, however, requires a massive amount of data that can be very noisy and can create a false sense of precision. We propose to use ego-centric sampling to reduce the amount of data required and to handle the inherent uncertainty in the data.

■ WC65

H-Room 202B, Second Floor

Multi-Item Inventory Management I

Contributed Session

Chair: David Shuman, University of Michigan, EECS Department, 1301 Beal Avenue, Ann Arbor, MI, 48109, United States of America, dishuman@umich.edu

1 - Inventory Decisions under Mixed Bundling Retailing

Wang Qiang, National University of Singapore, Ergonomics Lab, ISE Dept, NUS, Singapore, 119260, Singapore, g0600325@nus.edu.sg, Loo Hay Lee, Ek Peng Chew

We study how to make optimal inventory decisions, including ordering decision before selling season starts and allocation decision after demands are realized, under mixed bundling retailing when facing uncertain market size. We develop a two-stage stochastic model for both perfectly positively correlated demands and independent demands situations.

2 - Management of Consumer Driven Product Substitution

Dr Beirjandy, Sharif University of Technology, international campus Amirkabir Square, Kish Iland, Iran, dr.beirjandy@kish.ac.ir, Ali Kazeminia

Due to changes in engineering / market strategy, many substitutable parts / products are been developed. Substitution and co-formulation can reduce cost and improve service. We develop models and control mechanism for optimum substitution and joint ordering strategy and compare that with optimal policies without substitution.

3 - Single Period Co-production Problem: Analytical Solution and Optimal Substitution Strategies

Saurabh Bansal, UT Austin, Austin, Austin, TX, United States of America, Saurabh.Bansal@phd.mccombs.utexas.edu, James Dyer

Co-production systems simultaneously produce a number of vertically differentiated co-products that permit a downward substitution. We present an analytical solution to the single period problem of determining the optimal production lot size that maximizes the expected profit from all co-products under uncertain demand. The solution is easy to implement even for a large number of co-products. We also characterize the impacts of downward substitution on inventory and expected profit.

4 - Inventory Control of Multiple Items under Stochastic Prices and Budget Constraints

David Shuman, University of Michigan, EECS Department, 1301 Beal Avenue, Ann Arbor, MI, 48109, United States of America, dishuman@umich.edu, Owen Wu, Mingyan Liu

Motivated by a wireless communications application, we consider single and multiple item multi-period inventory models that feature stochastic ordering prices, deterministic demands, and budget constraints. In the case of a single item, we show that a modified base-stock policy is optimal, and present a method to identify the critical numbers. We then discuss the structure of the optimal policy for the multi-item model, and analyze implementable suboptimal policies.

■ WC66

H-Room 204A, Second Floor

Network Optimization I

Contributed Session

Chair: Jeff Kennington, Professor, Southern Methodist University, Lyle School of Engineering, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, jlk@lyle.smu.edu

1 - Optimal Relocation of Actors to Restore Connectivity in Wireless Sensor and Actor Networks (WSANs)

Mustafa Sir, Assistant Professor, University of Missouri, Industrial and Manufacturing Systems Eng, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, sirm@missouri.edu, Praveen Nagilla, Esra Sisikoglu, Sarah Root

Failure of some actors in a WSAN might partition the inter-actor network and thus make the WSAN unable to respond to events. Therefore, maintaining a connected inter-actor network at all times is critical. To restore connectivity when such failures occur, we use a mixed-integer programming formulation to find optimal relocation strategies for actors minimizing the total travel distance. In our formulation, we use powers of the adjacency matrix to generate constraints that ensure connectivity.

2 - Covering Two Level Network Design Problem

Macarena Donoso, PhD Student, Universidad Diego Portales, Ejarcito 441, Santiago, Chile, macarena.donoso@udp.cl

We formulated and solve a particular hierarchical network design problem. A main path is built between two points of the network, secondary paths start at each node of the main path. The objective is minimize the construction cost,

maximized the covered demand. The nodes that to be not covered, must be inside a distance coverage to the nodes of the network Applications are transport systems and telecommunications. We propose an integer programming formulation and an algorithm of resolution.

3 - The Uncapacitated Time-space Fixed-charge Network Flow Problem

Jeff Kennington, Professor, Southern Methodist University, Lyle School of Engineering, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, jlk@lyle.smu.edu, Charles Nicholson

Nodes and arcs of a network configuration replicated over time is a common structure found in many applications. A common cost structure for flows in arcs for such problems involves both a fixed and variable cost. We combine these two concepts to create the uncapacitated time-space fixed-charge network flow problem. In this investigation, we present a strategy for determining artificial arc capacities needed to model the fixed-charge component in a mixed binary linear programming formulation.

■ WC67

H-Room 204B, Second Floor

Algorithmic Developments in Stochastic Optimization I

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu

Co-Chair: Andrew Trapp, Bowling Green State University, trapp.andrew@gmail.com

1 - Dynamic Integer Optimization

Suvrajeet Sen, Professor, The Ohio State University, 1971 Neil Ave, Columbus, OH, 43210, United States of America, sen.22@osu.edu, Binyuan Chen, Yang Yuan

We will discuss a dynamic optimization algorithm for combinatorial optimization problems that evolve over time. The method is motivated by a combination of Nested Benders Decomposition, Local Convexification for Parametric MILP. This approach also requires that the validity of the cuts be maintained via the process of convexifying the right-hand-side of subproblems as in the Disjunctive Decomposition algorithm.

2 - Accelerated Stochastic Approximation for Stochastic Programming

Guanghui Lan, Georgia Tech, 765 Ferst Avenue, NW, Atlanta, GA, 30332, United States of America, glan@isye.gatech.edu

In this talk we consider an important class of convex programming problems whose objective function is given by the summation of a smooth and non-smooth component. We introduce an optimal method for solving this class of problems and present some promising computational results for this method applied to stochastic programing.

3 - On Global Optimization of Two-stage Stochastic Integer Programs

Andrew Trapp, trapp.andrew@gmail.com, Oleg Prokopyev, Andrew Schaefer

We consider two-stage pure integer stochastic programs with probabilistic right-hand sides, extending previous work which uses a tender space reformulation. We derive additional theoretical results to identify and exploit minimal tenders, and their subsequent use in generating the truncated integral monoid over which an optimal solution is guaranteed to exist. Algorithmic advancements based on preprocessing and global branch-and-bound ideas are discussed.

■ WC68

H-Room 206, Second Floor

Optimization with Stochastic Dominance Constraints

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Tito Homem-de-Mello, Northwestern University, Department of IEMS, Evanston, IL, 60208, United States of America, tito@iems.northwestern.edu

1 - A Convex Formulation of Multivariate Stochastic Dominance Constraints

Benjamin Armbruster, Northwestern University, 2145 Sheridan Rd., IEMS C210, Evanston, IL, United States of America, armbruster@northwestern.edu

This decade, stochastic dominance constraints were introduced to optimization problems. Extending stochastic dominance to random vectors, we say that random vector "a" has 2nd order stochastic dominance over random vector "b" if the expected utility of "a" is greater than the expected utility of "b" for all increasing, concave utility functions. I describe a convex formulation for multivariate, 2nd order stochastic dominance constraints.

2 - Incorporating Stochastic Dominance and Progressive CVaR Levels in Portfolio Models

Gautam Mitra, CARISMA, Brunel University, West London, United Kingdom, gautam.mitra@brunel.ac.uk, Diana Roman, Csaba Fabian, Viktar Zviarovich

Second order stochastic dominance (SSD) is recognised as an important choice criterion in portfolio selection, due to its relation to risk-averse economic behaviour. It has a strong relation to tail risk measures: a SSD model can be expressed as a minimisation of CVaRs at progressively increasing confidence levels. We generalise this concept and show that SSD based models can be used in the enhanced indexation: approach to portfolio choice seeking excess return.

3 - Multi-Criterion Homeland Security Resource Allocation Decision Using Stochastic Dominance

Jian Hu, Northwestern, 2145 Sheridan Rd., Northwestern University IEMS dept., Evanston, IL, 60208, United States of America, jianhu@northwestern.edu, Sanjay Mehrotra, Tito Homem-de-Mello

The paper proposes a linear random vector stochastic dominance constrained model applied to the optimal defensive resource allocation among potential terrorist targets. Mostly, an attack results in probabilistic losses on damaged properties, fatalities, and injuries. Balancing the three criteria, we consider a benefit in alleviating the losses. In particular, the linear random vector stochastic dominance is used to demand a better efficiency of our strategy over that of a given benchmark.

■ WC69

H-Indigo A, Second Floor

TV and Online Advertising

Sponsor: Marketing Science
Sponsored Session

Chair: Mihai Banciu, Bucknell University, 117 Taylor Hall, Lewisburg, PA, 17837, United States of America, mmb018@bucknell.edu

1 - The Value of Bundling in the TV Advertising Industry

Mihai Banciu, Bucknell University, 117 Taylor Hall, Lewisburg, PA, 17837, United States of America, mmb018@bucknell.edu, Prakash Mirchandani, Esther Gal-Or

Bundling prime and non-prime time slots is often an attractive revenue maximizing strategy for television networks, given that the advertising resources have fixed availability and are perishable. However, the economic impact of bundling on the advertisers is less clear. We formulate a monopolistic revenue optimization model. We study the properties of the economic value of bundling for the network and for the advertisers, and characterize situations where bundling is mutually advantageous.

2 - Multi-objective Optimization for Online Advertising Inventory Allocation - An Extension

Jian Yang, Yahoo!, 4301 Great Americs Parkway, Santa Clara, CA, 95054, United States of America, jianyang@yahoo-inc.com

Inventory allocation plays a critical role in revenue management for online advertising industry by supporting both contract booking and ad serving. An allocation plan is typically based on multiple business objectives, short-term or long-term, of monetary value or general benefit. We extend the existing multi-objective framework by including more objectives and modeling more features to achieve better business metrics in multiple objectives with shorter CPU time.

■ WC71

H-Indigo C, Second Floor

Remanufacturing in Inventory Management

Contributed Session

Chair: S. Phil Kim, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ksphil@purdue.edu

1 - A Two-product Remanufacturing System

Ek Peng Chew, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isecep@nus.edu.sg

We consider a two-product problem where each product has three options for assembly. The first option uses a new component while the other two options use a recycled component but with different remanufacturing cost. Moreover, the recycle components can be used to manufacture two products. For a single period problem, we show that the optimal policy exist. We also extend the problem to the multiperiod case by using this policy.

2 - Inventory Policy Characterization Method for a Manufacturing/Remanufacturing System

Semra Sebnem Ahiska, Assistant Professor, Galatasaray University, Industrial Engineering Department, Ciragan Cad. No:36 Ortakoy, Istanbul, 34357, Turkey, sahiska@gsu.edu.tr, Russell E. King

We consider the inventory control problem for a single product manufacturing/remanufacturing system. A search procedure benefiting from the results of Markov Decision Process is employed to determine inventory policy characterizations under several cost configurations and different manufacturing and remanufacturing lead times.

3 - Limits on Use of Returned Parts in After Market Products

Farhad Azadivar, Professor, University of Massachusetts Dartmouth, 285 Old Westport Road, Dartmouth, MA, 02748, United States of America, fazadivar@umassd.edu

Not all good parts in returned products can be recycled to produce aftermarket products. This paper demonstrates that if the source of parts for such products is solely good parts recovered from defective returned products the inventory of some of the good parts will be unbounded even if the defective rates for all parts of the product are identical.

4 - Stochastic Dynamic Lot Sizing for Hybrid Manufacturing/Remanufacturing System

S. Phil Kim, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ksphil@purdue.edu, Juan Jose Nativi, Seokcheon Lee

We address the dynamic lot sizing problem in a hybrid system under stochastic demands and returns. The objective is to find optimal dynamic lot sizes in order to minimize total expected cost over entire time horizon. A stochastic dynamic programming is employed to solve this problem. Several optimality conditions are defined and the structure of optimal solutions are found. Sensitivity analysis are conducted by numerical studies and provide a framework of decision supporting.

■ WC72

H- Indigo D, Second Floor

Nanotechnology

Contributed Session

Chair: Zeynep Ok, Graduate Research Assistant, Northeastern University, 334 Snell Engineering Center, 360 Huntington Avenue, Boston MA 02115, United States of America, zeynep@coe.neu.edu

1- Desirability Modeling for Safe Nanotechnology

Zeynep Ok, Graduate Research Assistant, Northeastern University, 334 Snell Engineering Center, 360 Huntington Avenue, Boston MA 02115, United States of America, zeynep@coe.neu.edu, James Benneyan, Jacqueline Isaacs

Given the significant uncertainty regarding nanomanufacturing health risks, we propose and illustrate the use of desirability functions modeling to select between workplace protection equipment options and to optimize fume hood design effectiveness against engineered nanomaterials. These models can help decision-makers develop a more informed understanding of trade-offs for safe handling of nanomaterials.

■ WC73

H-Indigo E, Second Floor

Optimal Control of Queues I

Contributed Session

Chair: Imry Rosenbaum, MSC Student, Tel-Aviv University, Tel-Aviv University,Ramat Aviv,P.O. Box, Tel-Aviv, 69978, Israel, imryro@yahoo.com

1 - Optimal Control of an Unreliable Multiserver Retrial Queue

Anahita Khojandi, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, anahitakhojandi@gmail.com, Jeffrey Kharoufeh

We analyze a multiserver retrial queueing system with heterogeneous servers that are unreliable. A controller assigns arriving customers to one of the up and idle servers or to the retrial orbit to try the system again later with the objective of minimizing the long-run average cost per unit time.

2 - Control of a Single-server Priority Queueing System with Customer Transfers

Jingui Xie, Tsinghua University, Department of Industrial Engineering, Beijing, China, xiejingui@gmail.com, Xiaobo Zhao, Qi-Ming He

This paper consider the control of a single-server priority queueing system with customer transfers. Two types of customers with different priority arrive to the system according to independent Poisson processes. While waiting in the system, the low priority customer can upgrade it priority after a random waiting time T. In order to minimize the delay of the high priority customers, different policies are considered.

3 - Admission Control and Routing with Quality of Service (QoS) Considerations in a Wireless Network

Emmanuelle Wallach, PhD student, the Pennsylvania State University, 703 East D Street, Belleville, IL, 62220, United States of America, ejw169@psu.edu, Natarajan Gautam, Tom M. Cavalier

We determine a fast and efficient algorithm for routing arriving calls into an Internet domain when there are multiple classes of traffic and QoS - bandwidth here - must be guaranteed for all classes. Here we explicitly take care of links and/or nodes failing, which requires rerouting traffic. The main challenge of this problem is that it aims at considering all the difficulties at once: efficiency of the algorithm, node or arc failure, rerouting in case of failure, and traffic congestion.

4 - Periodic Workforce Control in Service Systems with Lead Time Service Levels

Henny van Ooijen, Assistant Professor, Eindhoven Technical University, Technische Universiteit Eindhoven, PoBox 513, Eindhoven, Netherlands, h.p.g.v.ooijen@tue.nl, Will Bertrand, N.C Buyukkaramikli

The operational workforce planning has a periodic nature due to the coordination issues.Workforce control can be achieved by adjusting the number of working hours or active workers per period.If arrival and service times are random,both adjustments would introduce transient effects to the analysis.In this talk we focus on the analysis of service systems under workload-dependent and periodic workforce control policies which reduce labor costs significantly under lead time service levels.

5 - Reducing Mean Work-in-progress (WIP) in Open Jackson Networks

Imry Rosenbaum, MSC Student, Tel-Aviv University, Tel-Aviv University,Ramat Aviv, P.O. Box, Tel-Aviv, 69978, Israel, imryro@yahoo.com, Irad Ben-Gal, Uri Yechiali

We investigate dynamic reallocation and redistribution of service capacities in open Jackson networks so as to minimize mean total WIP in the system. Since the formulation as a general mathematical programming problem does not yield 'nice' solutions, we introduce and examine simple easy-to-implement rules in small network segments. We then propose techniques to apply these rules locally in larger networks in order to improve the system's overall performance.

■ WC74

H-Indigo H, Second Floor

Dynamic Programming Applications

Contributed Session

Chair: Gilberto Perez Lechuga, Engineering Doctor, Hidalgo State University, Reforma 113, El Arbolito, Pachuca, 42010, Mexico, glechuga2004@hotmail.com

1 - A Rule-based System-approach to System Health Improvement in a NASA Advanced Life Support System

Tze Chiam, PhD Candidate, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States of America, tzechao@purdue.edu, Yuehwern Yih

A rule-based system is constructed based on a Markov Decision Model to determine the selection of dynamic policies for a NASA Advanced Life-Support System. A methodology for capturing the "best" transition probabilities was developed and tested based on convergence of several system parameters. This system is able to provide policies for every state visited as well as those that were not previously visited during data collection. Analysis is done to compare and evaluate the solutions.

2 - Modeling and Sensitivity Analysis of the Replacement Problem: A Stochastic Approach

Gilberto Perez Lechuga, Engineering Doctor, Hidalgo State University, Reforma 113, El Arbolito, Pachuca, 42010, Mexico, glechuga2004@hotmail.com, Eva Selene Hernandez Gress

We modeled and analyzed the equipment replacement problem using Stochastic Dynamic Programming, decision Markov processes and matrix stochastic perturbation theory. We proved the existence of optimal policies of the model for certain class of utility functions. The robustness of the solutions is appraised from the perturbation of the transition probabilities matrix applying several types of bounds and probabilistic matrix norms.

Wednesday, 2:45pm - 4:15pm

■ WD01

C-Room 21, Upper Level

Decision Analysis and Support Systems

Contributed Session

Chair: John Lathrop, Scientist, Lawrence Livermore National Laboratory, P.O.Box 808, L-61, Livermore, CA, 94550, United States of America, lathrop3@llnl.gov

1 - Efficient Resource Allocation Mechanism for POMDP with Time-evolving Parameters

ChunTing Justin Lin, The University of Michigan, Ann Arbor, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, jctlin@umich.edu

A Partially Observable Markov Decision Process with multi-states is considered in this paper. We propose a position dependent transition model for illustrating the time evolving parameters. Our developing model formulation and algorithms are aimed to solve the intractable problem efficiently. Our proposed decision mechanism applies to wireless communication network and improves the data transmission rate on real time basis when the cost of probing and accessing channels are expensive.

2 - A Decision Aid Tool for High Speed Machine Selection

Shumail Mazahir, Student, ENSAM, 151 Boulevard Hopital, Paris, 75013, France, shumail.mazahir@gmail.com, Marc Lassagne, Guy Ishiomin, Jerome Duchemin

This paper presents a multi-stage decision analysis-based method to help make choices between several High Speed Machines by integrating technical data and expert opinion. The suggested approach addresses the decision-maker's level of expertise, the available data and its surrounding uncertainty. A case study illustrates the use of the method.

3 - Strategic Planning for Climate Change: Climate Impacts Assessment Meets Strategic Management

John Lathrop, Scientist, Lawrence Livermore National Laboratory, P.O.Box 808, L-61, Livermore, CA, 94550, United States of America, lathrop3@llnl.gov

Adaptation to climate change will occur within the long range strategic planning processes of companies and agencies. We are developing guidance for that adaptation by bringing together three bodies of knowledge: climate impacts projections; modeling of the client's systems environment; and the long range strategic planning process of that client. We will present the strategic planning support platform we have developed to do that in Lawrence Livermore's Energy and Climate Impacts Program.

■ WD02

C-Room 22, Upper Level

Decision Analysis Arcade II

Sponsor: Decision Analysis

Sponsored Session

Chair: Myron Hatcher, Professor, Craig School Of Business, California State University, 5245 North Backer Av M/S PB7, Fresno, CA, 93740, United States of America, myronh1225@hotmail.com

1 - Educating Rational Decision Makers About Uncertainty

Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

We make a case for improving the education of future rational decision-makers who will incorporate probabilistic thinking and not simply deterministic thinking in their processes of making decisions. An important issue is identified and addressed by the use of a simple mathematical model based on difference equations and generating functions which was implemented in Microsoft Excel along with the @RISK Monte Carlo Simulation program.

2 - Renewable Energy Decision Analysis

Dexin Luo, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, dexin.luo@gatech.edu, Valerie Thomas

We present an energy investment planning model, and implement real options analysis within a dynamic programming framework for alternative fuel technologies, incorporating uncertainties related to technology changes. We apply this model to a comparison of US renewable fuel options.

3 - A Myopic Approach to Ordering Nodes for Parameter Elicitation in Bayesian Belief Networks

Debarun Bhattacharjya, Risk Analystics Group, IBM Research, TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights NY 10598, debarunb@us.ibm.com, Léa Deleris, Bonnie Ray

Building Bayesian belief networks in the absence of data involves the challenging task of eliciting conditional probabilities from experts. Due to the number of assessments involved, experts may not be able to complete the entire elicitation process. In this paper, we develop analytical methods for determining the order in which parameters are to be elicited, in order to maximize some information-related criteria in case of early drop-off from the experts. We explore the implications of our results for typical parameter prior distributions used in the learning community, such as the uniform Dirichlet distribution.

■ WD03

C-Room 23A, Upper Level

Game Theory

Contributed Session

Chair: Pando Georgiev, Dr., Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, pando.georgiev@gmail.com

1 - Probabilistic Analysis of Simulation-based Games

Yevgeniy Vorobeychik, University of Pennsylvania, 15 Montgomery Ave, Apt. 6A, Bala Cynwyd, PA, 19004, United States of America, yev@seas.upenn.edu

Game Theory has proven invaluable in modeling interactions between self-interested parties. While traditional game theory relies on highly stylized models, many real settings (e.g., supply chains) can be modeled in high resolution using simulations. Thus, approaches have recently been introduced to perform game theoretic analysis using simulations. In this work, we contribute asymptotic analysis and confidence bounds on Nash equilibrium estimates, and introduce and analyze a new MAP estimator.

2 - Game Theory and KTC Optimization Techniques

William Fox, Professor, Naval Postgraduate School, 589 Dyer Rd, Room 103F, Monterey, CA, United States of America, wpfox@nps.edu

We examine game theory problems that are more easily solved finding the Nash equilibrium and Nash arbitrations points by applying the Kuhn-Tucker conditions for linear and nonlinear programming. We show that for games of 3 x 3 and larger that LP appears to be the method of choice. We apply Kuhn-Tucker conditions to find the Nash Arbitration point. Having found the status quo point (x^*, y^*) and create the convex polygon, we maximize $(x-x^*)(y-y^*)$ over the convex polygon using optimization.

3 - Repeated Congestion Games with Local Information

Marco Scarsini, LUISS, Viale Romania 32, ROMA, RM, 00197, Italy, marco.scarsini@luiss.it, Tristan Tomala

In congestion games considerable attention has been devoted to the inefficiency of Nash equilibria. In this work we study inefficiency of equilibria in repeated congestion game. A folk-theorem argument shows that the price of stability can often be reduced to 1 in the repeated game. The difficulty in proving a folk theorem for congestion games resides in the fact that the monitoring is only local, i.e., players observe only the routes that they go through.

4 - Parametrized Nash Equilibrium Problems and Applications to Electricity Markets

Pando Georgiev, University of Florida, Center for Applied Optimization, Gainesville, FL, 32611, United States of America, pandogeorgiev@gmail.com, Altannar Chinchuluun, Panos Pardalos

We consider a dynamic Nash equilibrium problem defined by partially convex functions depending on parameter and prove existence of of a solution which is an integrable function on the parameter. A new global optimization algorithm is presented. Applications to dynamical models of competition in electric power system network are considered.

■ WD04

C-Room 23B, Upper Level

Recommender Systems

Sponsor: Data Mining
Sponsored Session

Chair: Nick Street, Associate Professor, University of Iowa, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, nick-street@uiowa.edu

1 - Sampling Bipartite Graphs for Recommendation

Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, PA, 16802, United States of America, zanhuang@psu.edu

Sampling is the common practice involved in academic and industry efforts on recommendation algorithm evaluation and selection. Experimental analysis often uses a subset of the entire user-item interaction data available in the operational recommender system. This paper formally studies the sampling problem for recommendation to understand to what extent algorithm evaluation results obtained from different types of samples correspond with those obtained from the population data.

2 - Making Recommendations with Subsets of Related Features

Lian Duan, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, lian-duan@uiowa.edu, Nick Street

Recommender systems may suffer when predicting future purchases based on the full history of the user. E.g., multiple family members might use a single ecommerce account. Predictions may be more accurate if made from the isolated behavior of one person. We use correlations among items to divide a user's history into possibly overlapping parts, and consider the resulting predictions both individually and in combination. Experiments show the division improves predictive performance.

3 - Collaborative Filtering via Evolutionary Co-clustering

Mohammad Khoshneshin, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, mohammad-khoshneshin@uiowa.edu, Nick Street

Current collaborative filtering methods for recommenders are accurate but computationally expensive. Co-clustering via iterative algorithms is scalable and appropriate for dynamic settings but gives poor accuracy. We propose an evolutionary co-clustering method that finds high-quality solutions. The resulting solution population is used for ensemble prediction, improving the resulting accuracy. We explicitly promote diversity in the population to further improve predictive performance.

4 - Techniques for More Accurate and Diverse Recommendations

YoungOk Kwon, University of Minnesota, 321-19th Avenue South, Minneapolis, MN, 55455, United States of America, kwonx052@umn.edu, Gedas Adomavicius

Current advances in recommender systems focus mostly on improving recommendation accuracy; however, other important aspects, such as recommendation diversity, are often overlooked. While higher accuracy can be achieved at the expense of diversity and vice versa, the simultaneous improvement of both measures represents a non-trivial task. We propose new approaches that can generate more accurate and diverse recommendations by integrating ranking-based and multi-criteria rating techniques.

■ WD05

C-Room 23C, Upper Level

Joint Session QSR/Data Mining: Data Mining for Process Monitoring

Sponsor: Quality, Statistics and Reliability & Data Mining
Sponsored Session

Chair: Myong K. (MK) Jeong, Assistant Professor, Rutgers, the State University of New Jersey, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, mjeong@rci.rutgers.edu

1 - A Posterior Preference Articulation Approach to Multiresponse Surface Optimization

Dong-Hee Lee, POSTECH, Department of Industrial and Management, Pohang, Korea, Republic of, princeps@postech.ac.kr, In-Jun Jeong, Kwang-Jae Kim, Murat Koksalan

In multiresponse surface optimization (MRSO), responses are often in conflict. To obtain a satisfactory compromise, we propose a posterior preference articulation approach to MRSO. The proposed method initially finds a set of nondominated solutions, and then allows the DM to select the best solution among the nondominated solutions. The proposed method enables the DM to obtain a satisfactory compromise and gives him/her the opportunity to better understand the tradeoffs among the responses.

2 - One-class Classification-based Control Charts for Multivariate Process Monitoring

Seoung Bum Kim, Assistant Professor, Korea University, Anam-dong Seongbuk-Gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

One-class classification problems have attracted a great deal of attention from various disciplines. In the present study, we propose new multivariate control charts that apply the effectiveness of one-class classification to improvement of Phase I and Phase II analysis in SPC. A simulation study was conducted to demonstrate the effectiveness of our proposed control charts.

3 - Robust Support Vector Regression

Norman Kim, Rutgers, the State University of New Jersey, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, normank@rci.rutgers.edu, Myong K. (MK) Jeong, Sangheum Hwang, Bong-Jin Yum

SVR is one of the most popular datamining tools for solving regression problems. Due to its prediction performance, SVR has achieved great success in many area. In practice, however, data sets with outlier are frequently encountered, and therefore, the traditional SVR needs to be extended to handle such outlier. This paper proposes a novel robust SVR that is less sensitive to outliers. The proposed approach is compared with other existing regression methods in terms of prediction accuracy.

■ WD06

C-Room 24A, Upper Level

Panel Discussion: Challenges and Opportunities in Nanomanufacturing Process Modeling and Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

1 - Challenges and Opportunities in Nanomanufacturing Process Modeling and Control

Moderator: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Nanomanufacturing poses significant challenges for process modeling and control. A panel of discussants will share their experiences and perspectives regarding the tremendous research opportunities for QSR community.

■ WD07

C-Room 24B, Upper Level

Joint Session QSR/ HAS: Impact of Schedule Modeling on Quality

Sponsor: Quality, Statistics and Reliability & Healthcare Applications
Sponsored Session

Chair: John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

1 - Importance of Understanding Complex Interactions in Patient Arrival Patterns in Ambulatory Care

Christos Alexopoulos, Associate Professor, Georgia Institute of Technology, 438 Groseclose Bldg, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, christos@isye.gatech.edu

Numerous simulations assume normal Poisson distributions for patient inter-arrival patterns. This paper will present information generated from analysis of actual patient arrival patterns at several outpatient centers. The implications for clinic scheduling, patient flow and quality of care will be discussed and include several case studies.

2 - Analysis of Patient Arrival Times and Tardiness

Kamran Eftekhari, Senior Mathametician, UCSD School of Medicine, 9500 Gilman Drive, #0821, La Jolla, United States of America, keftekhari@ucsd.edu

Most discrete event simulations of emergency departments and outpatient centers make assumptions about patient tardiness and arrival patterns. This presentation will discuss findings from analysis of a data bank of observed patient arrival patterns and the impact different assumptions have on the predictive validity of simulations.

3 - Impact of Scheduling on Quality, Patient Satisfaction and Revenue

Daniel Bouland, Vice Chair, Clinical Operations, UCSD Department of Medicine, 9500 Gilman Drive, La Jolla, CA, United States of America, DBouland@ucsd.edu

Whether it's an emergency department or a specialty care clinic, understanding service demand and matching that to service capacity is critical. The scheduling schema implemented at a facility should reflect these dynamics but often do not. The impact on quality of care and revenue will be discussed as well some of the methodological and political challenges of changing present scheduling systems

4 - Understanding Patient Demand in Emergency Departments

Theodore Chan, Medical Director, Department of Emergency Medicine, UCSD, 9500 Gilman Drive, La Jolla, Ca, 92093, United States of America, tcchan@ucsd.edu

Emergency rooms are confronted by a number of critical constraints including having to see all patients, staffing demands that are dependent on both number and severity of patients, and dependencies on facilities outside of ED control (e.g. hospital beds or laboratory facilities). Failure to anticipate and plan for these constraints leads to overcrowding, diversions and 'sentinel events'. The methodological and political challenges in predicting and subsequent planning will be discussed

■ WD08

C-Room 24C, Upper Level

Adaptive Modeling in Multi-Stage Decision-Making

Sponsor: Data Mining
Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Industrial & Manufacturing Systems Engr., Campus Box 19017, Arlington, TX, 76019-0017, United States of America, vchen@uta.edu

1 - Tree-MARS Future Value Function Approximation in Stochastic Dynamic Programming

Subrat Sahu, University of Texas at Arlington, Industrial & Manufacturing Systems Engg, 420 Woolf Hall, Arlington, TX, 76019, United States of America, subrat@uta.edu, Victoria Chen, Seoung Bum Kim, Prashant Tarun

We present a flexible statistical modeling method called Tree-MARS to approximate future value functions in stochastic dynamic programming (SDP) problems with a mix of continuous and categorical state variables. Tree-MARS first fits a regression tree model, and then uses multivariate adaptive regression splines (MARS) to refine the model at the terminal nodes of the tree. Using a wastewater treatment SDP application, comparisons are made to using only MARS instead.

2 - A Fully Sequential, Self-organized Approach for Approximate Dynamic Programming

Huiyuan Fan, The University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Arlington, TX, 76019, United States of America, huiyuan.fan@mavs.uta.edu, Victoria Chen

The approach is built on two sequential concepts, sequential state space exploration and adaptive value function approximation. It can automatically and adaptively identify the state space regions and approximate the future value functions. The new method is demonstrated with a nine dimensional inventory forecasting problem.

3 - Efficient Computer Experiment Based Optimization Through Variable Selection

Dachuan Shih, Statistician, Conifer Health Solutions, 13737 Noel Rd., Dallas, TX, 75240, United States of America, thomas.shih@coniferhealth.com, Seoung Bum Kim, Jay Rosenberger, Venkata Pilla, Victoria Chen

A computer experiment based optimization approach employs design of experiments and statistical modeling to represent a complex objective function that can only be evaluated pointwise by solving an optimization subproblem. In large-scale applications, the number of variables is huge, and typically a large portion of these have little impact. This research studies data mining methods to conduct variable selection for an airline fleet assignment model using on only a small number of runs.

4 - Using Data Mining Tools to Generate an Efficient and Orthogonal Dynamic Programming State Space

Bancha Ariyajunya, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19019, Arlington, TX, 76019-0017, United States of America, bancha.ariyajunya@mavs.uta.edu, Seoung Bum Kim, Victoria Chen

Very large-scale stochastic dynamic programming (SDP) problems (> 50 dimensions) can be efficiently solved by combining data mining methods with computer experiments-based SDP. However, when the state variables are correlated, ideal experimental designs will not appropriately represent the state space. In this study, we extend the use of data mining tools to address multicollinearity. Results are presented for an Atlanta ozone pollution problem.

■ WD09

C-Room 25A, Upper Level

Statistics, Approximations and Monte Carlo Methods with Applications to Queues and Large Parallel Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Jose Blanchet, Columbia University, Mudd Building 340, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Sharp Asymptotics for Single-server Queues

Henry Lam, Columbia University, New York, NY, khl2114@columbia.edu, Jose Blanchet

I will talk about two sharp asymptotics for the stationary waiting time of single-server queue for heavy traffic, harnessing its representation as a random walk maximum. The first is a uniform large deviations result for a general class of subexponential queues over the real axis, linking Kingman's asymptotic on one end and heavy-tail asymptotic on the other via a tractable extra term in between. Our second asymptotic is a complete expansion for all the moments of a light-tailed queue.

2 - Statistical Analysis for Rare-event Probabilities

Jingchen Liu, Assistant Professor, Columbia University, 1255 Amsterdam Ave, Room 1030, New York, NY, 10027, United States of America, jcliu@stat.columbia.edu, Jose Blanchet

In this talk, we present several approaches of making statistical inferences on rare-event probabilities. Under this setting, the estimand tends to zero as the sample size tends to infinity. Regular inference procedures are subject to large relative bias. As we shall illustrate with simple examples, there are serious pitfalls that arise when using maximum likelihood estimate (MLE) or plugging in other consistent estimates of parameters to predict small probabilities.

3 - Task Assignment in Multiserver Queues with Highly Variable Workloads

Alan Scheller-Wolf, Associate Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu, Mor Harchol-Balter, Andrew Young

Researchers in operations and computer science have long considered how to schedule multiserver systems facing highly variable job sizes. Surprisingly, these researchers have come to largely contradictory conclusions. The operations papers have proved that it is often optimal to pool servers, while the computer science papers have shown that it is often optimal to segregate servers. We begin to rectify this conflict, establishing when and how servers should be pooled.

4 - Efficient Monte Carlo Estimation of Large Deviations Probabilities of Many Server Queues

Jose Blanchet, Columbia University, Mudd Building 340, New York, NY, United States of America, jose.blanchet@columbia.edu

We consider the problem of estimating steady-state loss probabilities for large multiserver queues with high arrival rates. Efficient simulation of such large deviations probabilities (as the system gets large) requires keeping track of a measure valued process. Our algorithms can be shown to be asymptotically optimal in the sense that the variance achieves the best possible decay rate to zero as the system gets large.

■ WD10

C-Room 25B, Upper Level

Metaheuristics I

Contributed Session

Chair: Maria Woodside Oriakhi, PhD Student, Brunel University, Mathematics Department, Brunel University, Uxbridge, United Kingdom, mapgmew@brunel.ac.uk

1 - A Tabu-search Algorithm for Finding Efficient Solutions to an MILP Model for Separation of Data

Cui Guo, Korea University, 1, 5-Ka, Anam-Dong, Seongbuk-Ku, Seoul, Korea, Republic of, guocui@korea.ac.kr, Hong Seo Ryoo

For the MILP model from Kim and Ryoo (2007) for the separation of data via a finite number of concurrently determined discriminant functions, we develop a tabu-search based meta-heuristic algorithm for fast optimizing the interplay of the individual functions in practice. We illustrate the basic idea of the algorithm with two-dimensional datasets and demonstrate its utility on six well-solved datasets from the literature.

2 - Testing a Tabu Search Idea: Allowing Tabu Tenures to Depend on Move Values

Halvard Arntzen, Molde University College, Britveien 2, Molde, Norway, halvard.arntzen@himolde.no, Arne Lokketangen, Lars Magnus Hvattum

A core idea in the tabu search metaheuristic is the use of a temporary tabu status for selected attributes of the visited solutions. We investigate a new variant of this idea, by allowing the tabu tenure of the attributes to depend on the value/quality of the move introducing them into the solution. Attributes introduced in a "good" move are fixed for more iterations. The idea is tested computationally using modified high quality tabu search implementations from different problem domains.

3 - Tabu Search Heuristic for the Core Node Location Problem (CNLP)

Hrvoje Podnar, Associate Professor, Southern CT State University, 501 Crescent St, New Haven, CT, 06515, United States of America, podnarh1@southernct.edu, Jadranka Skorin-Kapov, Darko Skorin-Kapov

We consider a design of optical networks, dealing with the placement of specially equipped nodes capable of re-distributing the traffic. In our scenario, a set of requests between edge nodes is given. The task is to find label switched paths (LSPs) for edge node requests given the set of potential core nodes. We present integer programming formulations and a heuristic strategy based on tabu search. The results show the efficiency of tabu search when applied to larger problem instances.

4 - Development of a New Echolocation-based Evolutionary Search Algorithm

Karla Gutierrez, MS Student, Industrial Engineering Department, The University of Texas at El Paso, 500 W. University Ave., El Paso, TX, 79968-0521, United States of America, krgutierrez@miners.utep.edu, Heidi Taboada, Christina Liang

This evolutionary algorithm is inspired by echolocation. Echolocation is the biological sonar system used by several animals such as dolphins, bats and whales. This new algorithm mimics the echolocation system that these animals use to search for their preys using ultrasound beams and multiple receivers. This algorithm searches for the optimal solution using a certain degree of angle as well. An example is presented to illustrate the working mechanism of the present algorithm.

5 - An Evolutionary Algorithm for Cardinality Constrained Efficient Frontiers

Maria Woodside Oriakhi, PhD Student, Brunel University, Mathematics Department, Brunel University, Uxbridge, United Kingdom, mapgmew@brunel.ac.uk, John Beasley, Cormac Lucas

An evolutionary algorithm for generating Markowitz mean-variance frontiers in the presence of cardinality constraints is presented. These frontiers are derived by combining two approaches, one where no constraint on return is imposed, the other where return is bounded. Empirical results are presented for publicly available test problems.

■ WD12

C-Room 26A, Upper Level

Optimization Software Frameworks

Sponsor: Computing Society
Sponsored Session

Chair: William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, wehart@sandia.gov

1 - Python Optimization Modeling Objects (Pyomo)

Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States of America, jpwatson@sandia.gov, William Hart, David Woodruff

We describe Pyomo, an open-source tool for modeling optimization applications in Python. Pyomo allows users to define abstract problems, create concrete problem instances, and solve these instances with standard solvers. Pyomo provides a capability commonly associated with algebraic modeling languages like AMPL. Pyomo leverages the Coopr software library, which integrates Python packages for defining optimizers, modeling optimization applications, and managing computational experiments.

2 - PySP: Modeling and Solving Stochastic Mixed-integer Programs in Python

David Woodruff, Professor, University of California Davis, UC Davis, Davis, CA 95616, Davis, CA, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson

We describe PySP, an open-source extension of Pyomo - a Python-based modeling language for mathematical programming - that facilitates modeling and solution of stochastic mixed-integer programs. PySP contains a number of generic decomposition-based solution strategies made possible through Python language features such as introspection. We discuss the design and implementation of these generic strategies, in addition to computational results on mixed-integer stochastic benchmarks.

3 - The Coliny Optimization Tool

William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, wehart@sandia.gov, John Siirola

We describe Coliny, an optimization tool that supports the application of COLIN optimizers. COLIN supports the rapid development of hybrid optimizers by providing a generic, flexible optimization interface that manages the transformation of data types between different optimizers. Coliny leverages COLIN to integrate a variety of optimization solvers, and these solvers can be flexibly applied within AMPL and with a simple XML specification.

■ WD14

C-Room 27A, Upper Level

Heuristics in Logistics and Transportation

Sponsor: Computing Society
Sponsored Session

Chair: Claudio Barbieri da Cunha, Associate Professor, University of Sao Paulo, Av. Professor Almeida Prado, trav 2, n.83, Cidade Universitaria, Sao Paulo, Brazil, cbcunha@esp.br

1 - An Alternative Heuristic to Solve the Shipper Collaboration Problem

Hugo Yoshizaki, Associate Professor, University of Sao Paulo, Av. Pr. Almeida Prado Trav. 2, n 128, Department Eng. Producao, Sao Paulo, 05508-900, Brazil, hugo@usp.br, Enrico Ferri

The shipper collaboration problem can be defined as how to identify tours in the set of lanes of all shippers that minimizes truck repositioning, and can be translated into a set covering formulation, the cardinality constrained lane covering problem (CCLCP), which is NP-hard. We present an alternative heuristic which solves larger instances than previous literature in near polinomial CPU time.

2 - Routing Containers in a Terminal: Blocks Relocation and Pre-marshalling

Stefan Voss, Professor, University of Hamburg, IWI - Institute of Information Systems, Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@hamburg.de, Marco Caserta, Silvia Schwarze

We focus on specific problems related to speeding up the horizontal transport of containers from the yard which are arising when storing (homogeneous) items, like boxes, pallets or coils, in stacks. We survey the state of the art and propose a move-based linear model for pre-marshalling and introduce two objective functions based on cost and stability issues. Solutions are obtained using a metaheuristic.

3 - New Simple and Efficient Heuristics for the Uncapacitated Single Allocation Hub Location Problem

Claudio Cunha, Universidade de Sao Paulo, Sao Paulo, Brazil, cbcunha@usp.br, Marcos Roberto Silva

In this talk, we present a simple and efficient multi-start tabu search heuristic as well as a two-stage integrated heuristic for the uncapacitated single allocation hub location problem, a problem widely studied in the area of location theory.. The results of our computational experiments, including benchmark CAB and AP data sets, as well as new larger instances show that our heuristics consistently return the optimal or best-known results in very short CPU times.

4 - Solving the Courier Scheduling Problem at FedEx Express

Bala Vaidyanathan, FedEx Express, Operations Research, Memphis, TN, 38125, United States of America, bala.vaidyanathan@fedex.com, Yen Soun, Atul Bhatt

Express transportation companies employ couriers to transport packages from the final stop in the network (stations) to customers, and to pickup packages from customers and bring them back to the station for transportation to their destinations. We study the Courier Scheduling Problem (CSP) at FedEx Express. We formulate the CSP as a set partitioning problem and develop an integer programming based algorithm to solve it. We also discuss practical issues related to implementation.

■ WD15

C-Room 27B, Upper Level

Hidden Linearity, Hidden Convexity, and Hidden Separability in General Nonlinear Programming — Uncovered, Reformulated, and then Transformed for Both Qualitative and Quantitative Exploitation III

Sponsor: Computing Society
Sponsored Session

Chair: Elmor Peterson, Systems Science Consulting, United States of America, elmor.peterson@gmail.com

1 - Shape-preserving Spline Approximation and Interpolation Via Generalized GP Conjugate Duality

Shu-Cherng Fang, Walter Clark Chair And University Alumni Distinguished Grad. Professor, North Carolina State University, Daniels 440, Raleigh, NC, 27695, United States of America, fang@ncsu.edu, John Lavery

Shape-preserving surface modeling using irregularly-spaced data points from irregular surfaces (such as urban terrain) has been accomplished with new non-conventional cubic L1 splines — reformulated and transformed with the aid of generalized geometric programming to exploit geometry-based parallel computing. This methodology is also potentially useful in soft-tissue modeling, pattern recognition, image compression, and the compressed sensing of correct signals from insufficient information.

2 - The Double-description Method for the Solution Sets for Finite Linear Systems

Brian Dandurand, PhD Candidate, Clemson University, Mathematical Sciences Department, Clemson, SC, United States of America, bdandur@clemson.edu, Matthew Saltzman

Providing all "extreme points" and all "extreme recession directionsas well as all "elementary bases" for the corresponding "lineality spacethis methodology (which is being implemented with open-source software in the COIN OR library) is the key computational tool in a promising new approach to stochastic linear programming, and is also an important ingredient in both qualitative and quantitative generalized geometric programming analyses.

3 - Markowitz Portfolio Selection via Generalized Geometric Programming

Shaun Willhite, US Air Force, United States of America, elpeters@ncsu.edu, Elmor Peterson

A reformulation of the Nobel-Prize-winning model as a generalized geometric programming problem that uses only the given budget and given input probability distributions (without the use of a cumbersome co-variance matrix) results in a new (simpler) completely separable convex quadratic programming formulation, and a correspondingly simple "conjugate-dual" formulation, which provide alternative solution algorithms and important new parametric and post-optimal sensitivity analyses.

■ WD16

C-Room 28A, Upper Level

Web Services

Sponsor: Information Systems
Sponsored Session

Chair: Sanjukta Smith, Assistant Professor, SUNY Buffalo, 325 Jacobs Management Center, Buffalo, NY, 14260, United States of America, sdsmith4@buffalo.edu

1 - Composing Decision Support Dashboards From Dataflow Web Services

Wolfgang Ketter, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, wketter@rsm.nl, John Collins, Maria Gini

We focus on separation of concerns between business users and software developers in the context of the Semantic Web. Our model envisions composable web "dataflow" services to reduce the cognitive burden of effective service composition, assisted by formal semantic descriptions of services, their interconnections, and interactive display components.

2 - Intermediation or Non-intermediation: A Market Design for Distributed Computing

Zhiling Guo, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21250, United States of America, zguo@umbc.edu, Gary Koehler, Andrew Whinston

In the Internet-based distributed computing environment, we propose an asynchronous optimization algorithm to coordinate distributed resource allocation in a double-auction, bundle-trading market run by a dealer. Based on a large-scale numerical experiment, we study the impact of the dealer's inventory policies on the computational market liquidity provision. We also take into account the effect of market communication patterns and agent learning strategies on market performance.

3 - Avoiding the Blind Spots: Competitor Identification Using Web Text and Linkage Structure

Gautam Pant, University of Utah, 1645 E Campus Center Drive, Salt Lake City, United States of America, gautam.pant@business.utah.edu, Olivia R. Liu Sheng

As the web presence of companies continues to grow, it is increasingly realistic to assume that the real-world competitive relationships are reflected in web content and links. Web services such as those made available by Yahoo provide an opportunity to leverage large volumes of processed web data and use it for recognizing competitor patterns. Using web data collected through APIs and web crawling for more than 2500 companies, we present a predictive modeling technique to identify competitors.

4 - Crowdsourcing the Next Best Idea

Vandana Ramachandran, Assistant Professor, University of Utah, Department of Operations and Info. Sys., 1645 East Campus Center Drive, Salt Lake City, UT, 84112-9301, vandana@business.utah.edu, Chris Ward

Crowdsourcing or harnessing the "wisdom of crowds" is today observable across a variety of domains. We study the dynamics of such participatory economies, where members are both producers and consumers, to identify patterns of community/network interactions and peer influence that may serve as early stage indicators of the success of crowdsourced content or ideas. Our results from examining one such thriving community provide several implications for its design and management.

■ WD17

C-Room 28B, Upper Level

Information Systems and Business Processes

Contributed Session

Chair: Kai Kossmann, Student, California State University, Sacramento, 6000 J Street, Sacramento, CA, 95819, United States of America, kai.kossmann@web.de

1 - Study on Application and Neediness of Extensible Business Reporting Language

Hongming Chen, Changsha University of Science and Technology, School of Economic & Management, Changsha City, China, chmdsh@163.com, Wenchuan Sun

Extensible Business Reporting Language (XBRL) has developed rapidly as one of accounting information processing standards and the latest technology. The advantages of XBRL were magnified. Based on system analysis on the research of XBRL in China and the research data samples selected from the Listed Companies in China Shanghai Stock Exchange, the test demonstrated that the present enterprises do not obtain the superior earnings from the XBRL application, thus enterprises cannot become the prime promoter of XBRL application. This paper proposes several methods and directions to solve or alleviate the problems this study found and questioned.

2 - WISE-BPM: Bridge From Business Process Model to IT System

Qinhua Wang, Research, IBM China Research Lab, Building19, Zhongguancun Software Park, Haidian District, Beijing, 100193, China, wangqinh@cn.ibm.com, Jin Dong, Bing Shao, Changrui Ren

IT system's most critical purpose is to support enterprise's business running, and the business process is fundamental for IT system implementation. However there is a huge gap between process and the IT system. WISE-BPM builds a bridge between business process modeling tool and IT system implementation platform. Through the bi-directional synchronization between business process model and system information model, WISE-BPM enables whole life-cycle process-centric IT system implementation.

3 - Making Our Intelligence Gathering Infrastructure Intelligent

Abhishek Sharma, Dir of Technology, MobileFusion Inc., 2715 Sarah Street, Pittsburgh, PA, 15213, United States of America, abhi@mfintel.com

Our vast intelligence, surveillance, and reconnaissance infrastructure is very collection heavy - collection capabilities outpace processing. Chief reason being we rely heavily on human eyes to monitor this infrastructure 24x7x365. In this paper we present an autonomous data analytics system to overcome this gap. Developed, and currently in early adoption within the various defense agencies this system is also one of its kind application of large-scale machine learning, and data mining.

4 - Analysis of Business Intelligence Solutions: A Comparison of the Bottom-up and Top-down Approaches

Kai Kossmann, Student, California State University, Sacramento, 6000 J Street, Sacramento, CA, 95819, United States of America, kai.kossmann@web.de

Business Intelligence Introduction Processes follow either a bottom-up or top-down approach. A bottom-up approach is driven by functional departments and sets an emphasis on data analysis. In contrast, a top-down approach is driven by senior management and focuses on strategic objectives. This research identifies strengths and weaknesses of both approaches. The results of the comparison are inputs for suggesting Event-Driven Process Chains as a methodology for BI implementation projects.

■ WD18

C-Room 28C, Upper Level

Optimization in Practice VIII - Scheduling

Sponsor: Computing Society
Sponsored Session

Chair: Carsten Jordan, Systems Analyst, Staff, Qualcomm, 7435 Park Village Rd, San Diego, CA, 92129, United States of America, cjordan@qualcomm.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - A Large Scale Enterprise Level Systems of Systems Simulation Tool

Gio Kao, Senior Technical Staff, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, 87185, gkkao@sandia.gov, Steven Handy

The Systems of Systems Analysis Toolset (SoSAT) Enterprise is a software application that was developed at Sandia National Laboratories. This is a large scale simulation tool that is capable of modeling the operations (i.e., logistics, reliability, maintenance, cost, resources, supply and repair chain management) of system of systems organizational structure from the supplier to the end-user level within larger systems.

2 - A Master Scheduling Problem in the Qualcomm Chip Supply Chain

Carsten Jordan, Systems Analyst, Staff, Qualcomm, 7435 Park Village Rd, San Diego, CA, 92129, United States of America, cjordan@qualcomm.com, Harpreet Grewal

Qualcomm manages multiple foundries, and assembly and test facilities in its chip supply chain. We describe a master scheduling problem which arises when the same end product can be produced in different ways using different paths in the supply network. We also highlight the challenges when implementing a solution in the current business processes and systems.

3 - Developing and Deploying a Near Real Time Optimization and Scheduling System for Semiconductor Fabs

Amal De Silva, Principal Consultant, ILOG (an IBM company), 1195 W Fremont Ave, Sunnyvale CA 94087, United States of America, adesilva@us.ibm.com, Michel Jaczynski

We have designed a near real time system to generate optimized schedules of tools in the context of semiconductor Fabs. We will present our experiences in order to develop and deploy such optimization solutions in this challenging environment. The solution architecture is capable of generating updated schedules every couple of minutes to react to changes. As the system is fully automated, the validation of the scheduling engine requires detailed testing during development and gradual deployment.

■ WD19

C-Room 28D, Upper Level

Freight Transportation

Contributed Session

Chair: Inamulla Iyoob, Director Engineering, Transplace, 509 Enterprise Dr, Lowell, AR, 72745, United States of America, inam.iyoob@transplace.com

1 - Impact of Automated Inspection Technology on Railroad Capacity and Operational Efficiency

Bryan Schlake, Graduate Research Assistant, University of Illinois at Urbana/Champaign, B-118 Newmark Civil Engineering Lab, 205 N. Mathews Avenue, Urbana, IL, 61801, United States of America, schlake@illinois.edu, J. Riley Edwards, Christopher P.L Barkan

Railroad terminal performance directly impacts overall network capacity. Technologies are being developed to automate railcar inspection, one process in the system of terminal operations. This research investigates factors affecting the economic impact of these technologies and explores potential gains to yard capacity and efficiency resulting from automated railcar inspection. The ultimate objective of this research is to analyze the net benefit of implementing automated inspection technology.

2 - Impact of Lane Volume Variability in Forecasting Lane Volumes for Truckload (TL) Service Procurement

Inamulla Iyoob, Director Engineering, Transplace, 509 Enterprise Dr, Lowell, AR, 72745, United States of America, inam.iyoob@transplace.com, Ed Pohl, Scott Mason

Shippers consider the impact of lane demand variability when forecasting annual volumes for TL service procurement events, as inflating estimated volumes to cover peak periods can result in underutilization of core carrier awarded capacity. However, if a shipper deflates annual volume to represent regular day-to-day demand, core carriers will not have available capacity to cover peak volume requirements. We introduce metrics to forecast annual volumes to support procurement bids for TL service.

■ WD20

C-Room 28E, Upper Level

Queuing Models in Air Traffic Management

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, Department of Civil Engrg., 1173 Martin Hall, College Park, MD, 20742, United States of America, lovell@umd.edu

1 - Diffusion Approximation to Networks of Airport Queues

Kleoniki Vlachou, Graduate Researcher, University of Maryland, College Park, 3117 A.V.Williams Bld, College Park, MD, 20742, United States of America, kvlachou@umd.edu, David Lovell

For the modeling of airport queues we use a different approach based on a continuum approximation to queuing problems adapted from the well-known diffusion approximation, as encapsulated in the Kolmogorov forward equation. First we will present the mathematic formulation of the problem. Then we will present the numerical solutions found based on the finite element method. Finally we will present the results we got for different combinations of airport networks.

2 - Queueing Models with Scheduled Arrivals for 4-D Aircraft Operations

Tasos Nikoleris, PhD Candidate, UC Berkeley, 109 McLaughlin Hall, University of California, Berkeley, CA, 94720, United States of America, nikoleris@berkeley.edu, Mark Hansen

This paper develops a queueing model for aircraft landings at a single runway under trajectory-based flight operations. The situation is expected to arise in NextGen. Aircraft are assigned scheduled times of arrival, which they meet with some stochastic error. A recursive queueing model is formulated, and Clark's approximation for the maximum of a finite set of normal random variables is employed.

3 - Time Dependent Queuing Models of the National Airspace System

Chatabush Roongrat, PhD Student, The University of Texas at Arlington, P.O. Box 19017, The University of Texas at Arlington, Arlington, TX, 76019, United States of America, chatabush.roongrat@mavs.uta.edu, Jay Rosenberger, Sukrut Joshi, Prasenjit Sengupta, Monish Tandale

Time dependent queuing models of the National Airspace are developed in which the inter-arrival distribution is a time-dependent piece-wise constant Coxian random variable, and the service time distribution is a Coxian random variable. We described an algorithm for calibrating a queuing model from simulated FACET data of an Air Route Traffic Control Center and an algorithmic approach to determine average measures of the queues. Finally, we give future directions for studying such queuing models.

■ WD21

C-Room 30B, Upper Level

Facility Logistics: Facility Design

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu

1 - The Effect of Aisle-width and Storage Policy on Space and Throughput in a Distribution Center

Pratik Parikh, Assistant Professor, Wright State University, 3640 Col. Glenn Hwy, 207 Russ Engr Center, Dayton, OH, 45435, United States of America, pratik.parikh@wright.edu, Russell Meller, Kevin Gue

Designing aisles and selecting a storage policy are two of the several key decisions involved in designing a distribution center (DC). Aisle-design includes the determination of aisle layout along with number, length, and width of aisles. Storage policies could vary from randomized storage to sophisticated volume-based storage. We conduct a simulation study to understand the interaction between various aisle designs and storage policies from a space and throughput standpoint.

2 - Improving the Fishbone: A New Design for Aisles in a Warehouse

Omer Ozturkoglu, Research Assistant, Auburn University, 3339 Shelby Center, Auburn, 36832, Turkey, ozturom@auburn.edu, Kevin Gue, Russell Meller

We present a model for travel in a unit-load warehouse that allows cross aisles and picking aisles to take on any angle. We also show that, for any warehouse with picking and cross aisles at specified angles, there exists a dual warehouse with these angles exchanged that has the same expected cost.

3 - A New Warehouse Aisle Design for a Task-interleaving Environment

Letitia Pohl, Department of Industrial Engineering, University of Arkansas, Fayetteville, AR, 72701, United States of America, lpohl@uark.edu, Kevin Gue, Russell Meller

We investigate a new aisle design for unit-load warehouses that interleave storage and retrieval operations to form dual-command cycles. We refer to this design as fishbone triangle, and compare its performance to the fishbone aisle design and traditional aisle layouts. We find that the new design reduces expected travel-between distances over a fishbone design, but at the cost of increasing single-command travel distances and warehouse area.

4 - Modeling University Campuses' Transportation Systems in TRANSIMS

Adel Sadek, Associate Professor, University of Buffalo, Civil, Structural & Environmental Engine, 233 Ketter Hall, North Campus, Buffalo, NY, United States of America, asadek@buffalo.edu, Irene Casas, Liya Guo

The main objective of the current study is to evaluate the feasibility of using TRANSIMS, an agent-based model capable of simulating travel on a person-by-person and second-by-second basis, to model transportation on college and university campuses. As a case study, we consider the transportation network of the North campus of the University at Buffalo (UB), the State University of New York. The focus of the presentation is on trip-based implementations of TRANSIMS.

■ WD22

C-Room 30C, Upper Level

Network Design in Transportation

Contributed Session

Chair: Guven Kaya, PhD Candidate, Texas A&M University-Department of Industrial and Systems Engineering, 241 Zachary 3131 TAMU, College Station, TX, 77843, United States of America, guvenkaya@neo.tamu.edu

1 - Network Design Analysis for Special Needs Student Services

Behrooz Kamali, Graduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bkamali@uark.edu, Scott Mason, Ed Pohl

Special needs and medically fragile students ride specialized buses to schools in their area that house the services required for these students. Unfortunately, special needs services-to-school assignments often are made without any consideration of student geographical locations. We present models that seek to maintain administration-based performance measures while simultaneously reducing student bus travel times via smarter network assignments and more effective bus routing decisions.

2 - Sensor Location for Route Identification on a Transportation Network

Monica Gentili, Dr, University of Salerno, Via Ponte Don Melillo, Fisciano, SA, 84084, Italy, mgentili@unisa.it, Raffaele Cerulli, Francesco Sbordone

We address the problem of optimally locating sensors on a transportation network for route identification. A mathematical model and alternative solution approaches are presented and discussed.

3 - Optimal Number and Location of Bluetooth Sensors for Travel Time Data Collection in Networks

Mona Asudegi, Graduate Student, University of Maryland, 4307 Rowalt Drive, Apt 302, College Park, MD, 20740, United States of America, asudegi@umd.edu, Ali Haghani

Recently, the Bluetooth technology is introduced to Intelligent Transportation Systems to collect traffic data in urban and rural areas. This study aims at finding the optimal locations for Bluetooth sensors while maximizing travel time reliability and link coverage as well as minimizing the cost. Different formulations are compared and applied to real world traffic networks.

4 - Inspection Allocation and Policy Optimization in Port-of-entry Systems

Christina Young, PhD Candidate, Rutgers University, Industrial and Systems Engineering Dept, Piscataway, NJ, 08854, United States of America, cms168@rci.rutgers.edu, Elsayed Elsayed

Container inspection is a vital part of maintaining secure ports-of-entry, and an optimal policy is desirable. We consider the case where containers may contain distinct categories of cargo which constitute various types of risks. The performance of the system is affected by the precision of the sensor used and also the choice of threshold level. The precision and threshold settings are optimized concurrently with the inspection allocation, obtaining an overall optimal system operation.

5 - Integration of Facility Location and Layout of Intermodal Transportation System with Scheduling

Guven Kaya, PhD Candidate, Texas A&M University-Department of Industrial and Systems Engineering, 241 Zachry 3131 TAMU, College Station, TX, 77843, United States of America, guvenkaya@neo.tamu.edu, Ceyda Oguz, Metin Turkay

The intermodal freight transportation combines several different modes of transportation. Ro-La is the railway transport line carrying vehicles on rails, rather than on roads. First, we obtained initial layouts for stations with an improvement algorithm. Next, we formulated a train scheduling IP model. Consequently, facility layout and train scheduling models were combined to form the integrated model. The model was solved for the freight transportation system,to be operated in Istanbul, Turkey.

■ WD23

C-Room 30D, Upper Level

Operations Research at the Joint IED Defeat Organization

Sponsor: Military Applications Society
Sponsored Session

Chair: Ronald Woodaman, Operations Research Analyst, C4I Center, George Mason University, 17 Planters Place, Stafford, VA, 22554, United States of America, rwoodama@netlab.gmu.edu

1 - Operations Research in the Counter IED Fight

Bill Sentlinger, Deputy Division Chief, J9, Joint IED Defeat Organization, 5000 Army Pentagon, Washington, DC, 20310, United States of America, bill.sentlinger@jieddo.dod.mil

In January 2006, the Joint IED Defeat Organization (JIEDDO) was established to focus (lead, advocate, coordinate) all DoD actions to defeat the Improvised Explosive Device (IED) as a weapon of strategic influence. To enable the JIEDDO mission, operations research is employed to provide JIEDDO leadership with an analytically derived, empirically supported basis for decisions regarding options to minimize the impact of IEDs.

2 - Modeling Route Clearance and Convoy Operations to Minimize IED Risk

Dan Stimpson, C4I Center/George Mason University, 4400 University Drive, MS 4B5, Fairfax, VA, 22030, United States of America, dstimpso@gmu.edu, Kellen Leister, Kevin Curtin

IEDs pose a risk to convoys operating on supply routes in theaters of war. Route Clearance Teams (RCTs) help mitigate this risk. We will introduce modeling techniques developed by George Mason University to support JIEDDO. Our goal is to develop optimal RCT scheduling strategies for minimizing IED risk to convoys. We will address the spatiotemporal characterization of IEDs, estimation of IED detection rates by RCTs, IED emplacement rates following RCTs, and RCT/convoy coordination modeling.

3 - Optimal Counter-IED Portfolio Selection
Ronald Woodaman, Operations Research Analyst, C4I Center, George Mason University, 17 Planters Place, Stafford, VA, 22554, United States of America, rwoodama@netlab.gmu.edu, Charles Twardy, Andrew Loerch, Karla Hoffman

Every week the Joint Improvised Explosive Device Defeat Organization must select whether or not to fund one or more new counter-IED initiatives. These frequently arrive seeking funding with little time for deliberate analysis. The urgency imposed by the IED threat requires that JIEDDO rapidly decide. The authors describe the research to date in aiding JIEDDO to develop a rigorous, transparent, and repeatable decision process for optimizing its portfolio selection.

4 - Dynamic Airborne Resource Reassignment with Anticipatory Targets
Chase Murray, PhD Candidate, University at Buffalo (SUNY), 308A Bell Hall, Buffalo, NY, 14260, United States of America, cmurray3@buffalo.edu, Mark Karwan

During the course of a mission, changes in battlespace conditions necessitate the dynamic reassignment of aircraft to complex tasks. In addition to responding to known threats, it may also be advantageous to proactively plan for the appearance of future targets. Due to the time-critical nature of this problem, rapid solution approaches that balance potentially competing objectives of maximizing mission effectiveness and minimizing changes to initial assignments are required.

■ WD25

C-Room 31A, Upper Level

OR at AD OPT

Sponsor: Aviation Applications
Sponsored Session

Chair: Carl Mitchelson, OR Software Architect, AD OPT, 3535 Queen Mary Road, Suite 650, Montreal, QC, H3V1H8, Canada, Carl.Mitchelson@Kronos.com

1 - Solving Large Scale Strict-Seniority Preferential Bidding Problems
Carl Mitchelson, OR Software Architect, AD OPT, 3535 Queen Mary Road, Suite 650, Montreal, QC, H3V1H8, Canada, Carl.Mitchelson@Kronos.com, Yvan Dumas

Large-scale strict-seniority preferential bidding problems are extremely hard to solve. We present significant advances in solving these problems using a column generation approach. The proposed algorithm monitors the state of the problem before making branching decisions, allowing for steady convergence towards integer solutions. Numerical results will be presented for categories of up to 6000 crew members.

2 - Simultaneous Optimization of Crew Pairings and Monthly Blocks
Norbert Lingaya, Manager of OR, AD OPT, 3535 Queen Mary Road, Suite 650, Montreal, QC, H3V1H8, Canada, norbert.lingaya@kronos.com, Mohammed Saddoune, Francois Soumis, Guy Desaulniers

The crew scheduling problem is usually solved by a traditional two-phase approach: pairing optimization and monthly block optimization. The global problem of producing monthly blocks from flight legs is a huge problem. We solve it using column generation to reduce the number of variables and constraint aggregation to reduce the number of constraints. This new technique allows to reduce by 3.3% the number of blocks obtained by the traditional approach on real life small and medium size problems.

3 - Handling of Specific Crew Qualifications and Crew Types When Building Crew Pairings
Remy Gauthier, Manager of Products, AD OPT, 3535 Queen Mary Road, Suite 650, Montreal, QC, H3V1H8, Canada, remy.gauthier@kronos.com

Many airlines must manage specific crew qualifications during the monthly schedule construction process. These qualifications range from specific route languages, cabin classes of service, to cockpit ranks. This presentation will look at various needs expressed by airlines, and propose a solving and management approach usable at anonymous crew pairing level.

■ WD27

C-Room 31C, Upper Level

Simulation and Optimization

Contributed Session

Chair: Jong-hyun Ryu, Purdue University, 315 N. Grant St., West Lafayette, IN, 47906, United States of America, ryuj@purdue.edu

1 - Large Scale Production Optimization Using a MINLP Approach
Kashif Rashid, Research Scientist, Schlumberger-Doll Research, One Hampshire Street, Cambridge, MA, 02319, United States of America, krashid@slb.com, Benoit Couet, Suleyman Demirel

A methodology to treat large-scale surface network models for hydrocarbon revenue maximization in the presence of various operating constraints is presented. The control variables include continuous gas-lift injection and discrete or continuous sub-surface chokes. As each simulation is costly and derivatives are unavailable, an efficient technique for handling such MINLP problems is proposed.

2 - Kriging Metamodeling in Simulation Optimization
Mehdi Zakerifar, PhD Student, University of Louisville, Department of Industrial Engineering, University of Louisville, Louisville, KY, 40292, United States of America, m0zake01@louisville.edu, Gerald Evans

Kriging is a geostatistical interpolation method that predicts unknown values of a random function based on a weighted linear combination of all values already observed. This technique has been widely used in areas as diverse as geology, logistics, and manufacturing. In our approach, we will define the Kriging metamodeling as a tool for simulation optimization; and then we will compare Kriging methodology with the other standard interpolation methods within an experiment.

3 - A Screening Model to Explore Planning Decisions in Manufacturing Systems under Demand Uncertainty
Yingxia Yang, Massachusetts Institute of Technology, 550 Memorial Dr, Apt.11b3, Cambridge, MA, 02139, United States of America, yingxia@mit.edu, Randolph Kirchain, Richard Roth

This research develops a method to design manufacturing systems for uncertainty. It couples a screening model to identify designs with an evaluation model to evaluate identified solutions. By using the adaptive One Factor At a Time method with a Response Surface method and simulation-based linear optimization, the screening model efficiently explores a large decision space that is computationally intractable for conventional optimization, which is demonstrated by a case study.

4 - Multiobjective Simulation Optimization Using Adaptive Weighted Sum Method
Jong-hyun Ryu, Purdue University, 315 N. Grant St., West Lafayette, IN, 47906, United States of America, ryuj@purdue.edu, Sujin Kim, Hong Wan

This work proposes a new method for approximating Pareto front of multi-objective simulation optimization problems where the explicit forms of the objective functions are not available. The new scheme iteratively approximates the objective functions using metamodels and searches for the points on the Pareto front using weighted sum method. The numerical results show that the proposed algorithm efficiently generates evenly distributed points for various types of Pareto fronts.

■ WD29

H-Room 501, Fifth Floor

Risk Management

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Niko Iliadis, EnerCoRD, Plastira Street 4, Nea Smyrni, Athens, 171 21, Greece, niko.iliadis@enercord.com

Co-Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

Co-Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - Stochastic Programming Models for Multi-period Energy Planning with Emphasis on First-stage Decision
Yan Wang, PhD Candidate, Iowa State University, 3004 Black Engineering, Ames, IA, 50011, United States of America, yanwang@iastate.edu, Sarah Ryan

Many applications of multi-period stochastic programming retain only the first-stage solutions due to forecast revision and uncertainty resolution. We propose a rolling two-stage procedure for energy planning problems with uncertain fuel costs and energy demands. The accuracy of the first-stage decisions is compared

to that from the traditional multi-stage formulation. A heuristic scenario reduction algorithm focusing on the first-stage solution is developed to reduce the computational burden.

2 - Portfolio Risk Management and Carbon Emissions Valuation in Electric Power

Paul R. Kleindorfer, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, kleindorfer@wharton.upenn.edu, Lide Li

Under the cap and trade system implemented in the European Union, and under similar plans under discussion in the United States, the value of an energy investment will be the joint product of its cash flows and the implied value/cost of carbon emissions or reductions associated with the investment. This paper extends the dynamic portfolio problem in electricity supply as developed in our earlier work to encompass the new markets for carbon, and hedging instruments defined on these.

■ WD30

H-Room 502, Fifth Floor

Planning and Scheduling in Energy

Contributed Session

Chair: Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States of America, son@sie.arizona.edu

1 - Optimal Short-term Scheduling for a Thermal Power Producer in a Competitive Electricity Market

Jose Prina, Pontificia Universidad Catolica de Chile, Department of Industrial and Systems Eng, Av. Vicuna Mackenna 4860, Santiago, Chile, jprina@ing.puc.cl, Sujin Kim

We consider the short-term scheduling problem for a thermal power producer in a competitive electricity market. The objective is to maximize the expected profit from energy selling for a 24-hour time horizon with hourly stages, under electricity spot price uncertainty. The solution methodology is based on approximate dynamic programming.

2 - Long Term CO2 Sequestration System Modeling

Yidong Zhang, University at Buffalo, University at Buffalo, 308A Bell Hall, Department of Industrial and System Eng, Buffalo, NY, 14260-1900, United States of America, yz46@buffalo.edu, Mark Karwan

A general model for long term planning of a system of coal burning power plants and CO2 sequestration, considering many factors (e.g. construction and operation of new plants, retrofitting of existing plants, pipelines and injection wells for CO2 storage, expansion of the electric grid), is presented. We demonstrate the model using various scenarios (e.g. increasing demand rates, environmental regulations and permits). Examples and computational results are discussed.

3 - Capacity Planning and Operational Decision-making in Integrated Photovoltaic Generation with Storage

Seungho Lee, PhD Candidate, The University of Arizona, Systems and Industrial Engineering, Tucson AZ 85721, United States of America, mountlee@email.arizona.edu, Nurcin Celik, Esfandyar Mazhari, Young-Jun Son, Melody Zhao

A decision-evaluation tool is proposed for a scenario, where PV and conventional generators and storage are used to meet demands. The tool, which is based on hybrid simulation and meta-heuristic, has been used to test impact of future demand growth and efficiencies in PV and storage on the total cost of the system and an optimal mixture of PV generation, conventional generation, and storage capacity. The tool is also used for operational decisions considering the dynamic price of electricity.

■ WD31

H-Room 503, Fifth Floor

Applications in Revenue Management

Sponsor: Revenue Management and Pricing

Sponsored Session

Chair: Luce Brotcorne, University of Valenciennes, LAMIH SIADE, Le Mont Houy, Valenciennes, France, Luce.Brotcorne@univ-valenciennes.fr

1 - Dynamic Cruise Ship Revenue Management

Lama Moussawi, Assistant Professor, School of Business, American University of Beirut, POBox 11-0236 Riad El Solh, Beirut, 1107-2020, Lebanon, lm34@aub.edu.lb, Bacel Maddah, Hussein Rida, Muhammad El Taha

Recently, it has been recognized that cruise ship revenue management is different from that of airlines or hotels due to the presence of multiple capacity constraints in cruise ships. We develop a discrete-time dynamic capacity control model for managing customer requests and show that the opportunity cost of accepting a customer is not monotone in the reservation levels or time. We develop several heuristics, test their performance and obtain important managerial insights.

2 - The Morning Commute Problem with Coarse Toll and Nonidentical Commuters

Feng Xiao, UCDavis, 416 Russell Park, Apt.2, Davis, CA, 95616, United States of America, sheffi2004@gmail.com, Michael Zhang, Zhen (Sean) Qian

This paper studies the morning commute problem under a flat peak-period toll within the context of heterogeneous commuters. All the possible queuing profiles resulting from different choices of toll level and charging time interval are examined. We find that commuters in the middle pack of the value-of-time distribution are more easily to be hurt and the optimal solution depends on the units in which the system cost is measured.

3 - The Freight Rail Capacity Allocation Problem

Luce Brotcorne, University of Valenciennes, LAMIH SIADE, Le Mont Houy, Valenciennes, France, Luce.Brotcorne@univ-valenciennes.fr, Yezekael Hayel, Dominique Feillet, Ioana Bilegan

We consider a freight rail transportation problem where a carrier strives to maximize revenue by efficiently allocating capacities taking into account punctual demands as well as estimations of future demands for container transportation. We propose a revenue management approach based on solving a mathematical program with respect to a space-time transportation network. Numerical results are discussed.

■ WD32

H-Room 504, Fifth Level

Portfolio Analysis I

Contributed Session

Chair: Ethem Canakoglu, The University of Warwick, Warwick Business School, Coventry, CV4 7AL, United Kingdom, Ethem.Canakoglu@wbs.ac.uk

1 - Dynamic Hedge Fund Asset Allocation under Multiple Regimes

David Cru, Stony Brook University, Applied Math Department, 17 Schenck Ave, Apt 3c, Great Neck, 11021, United States of America, dcru@ams.sunysb.edu

Portfolio Selection under the assumption that asset returns follow a normal distribution and that investors are indifferent to higher moments are not suited for the hedge fund environment. Lockup and Notice provisions built into the contracts make rebalancing difficult and justify the need for dynamic allocation strategies. Generalizing the asset returns to a Multivariate Gaussian Mixture Distribution we propose rebalancing strategies for hedge fund portfolio problems.

2 - Portfolio Margining: Strategy vs Risk

Dmytro Matsypura, The University of Syndey, 478 Merewether Building H04, Sydney, 2006, Australia, d.matsypura@econ.usyd.edu.au, Ed Coffman, Vadim Timkovsky

The risk-based approach to margining portfolios with equity derivatives is known to yield substantially lower margin requirements in comparison with the strategy-based approach that has been used for margining customer accounts more than 4 decades. This paper proposes a mathematical and experimental analysis of both approaches and provides recommendations on ways to achieve adequate margin requirements.

3 - A Multi-objective Dynamic Portfolio Optimization with Short Selling Variables

Bartosz Sawik, AGH University of Science & Technology, Faculty of Management, Department of Applied Computer Science, al. Mickiewicza 30, Krakow, 30-059, Poland, B_Sawik@yahoo.com

Mixed integer programming formulation with a weighting approach is proposed for dynamic portfolio optimization with short selling variables over many investment periods, each consist of 250 historic quotations. The objective is to allocate wealth on assets to maximize the weighted difference of the portfolio expected return and the threshold of the probability that the return is not less than a required level. A real data from stock exchange were used as a tool for computational experiments.

4 - Continuous Time Portfolio Selection in Stochastic Markets

Ethem Canakoglu, The University of Warwick, Warwick Business School, Coventry, CV4 7AL, United Kingdom, Ethem.Canakoglu@wbs.ac.uk

We analyzed a Black-Scholes type continuous time models where the market parameters are driven by Markov processes. The problem of maximizing the expected utility from terminal wealth is investigated and solved by stochastic control methods for different utility functions involving exponential, logarithmic and power function. We found explicit solutions for optimal policy, the associated value functions and the optimal wealth process.

■ WD34

H-Room 520, Fifth Floor

Environmental Operations II

Contributed Session

Chair: Muharrem Mane, Purdue University, 701 W Stadium Ave, West Lafayette, In, 47907, United States of America, mane@purdue.edu

1 - Incentive-based Regulation of Pollution From Complex Processes

Sung Hoon Chung, The Pennsylvania State University, 244 Leonhard Bldg., University Park, PA, 16802, United States of America, sxc447@psu.edu, Robert Weaver, Terry Friesz

Production most often involves a set of convoluted processes, some of which contribute more directly to environmental effects and some which are more effective in managing such effects. We consider continuous and periodic dynamics processes that produce perishable as storable intermediate and final outputs and jointly generate environmental effects. We discuss management options that maximize profit over the planning horizon while reducing environmental effects.

2 - Assessing Market and Environmental Impacts of an N+3 Supersonic Aircraft

Muharrem Mane, Purdue University, 701 W Stadium Ave, West Lafayette, In, 47907, United States of America, mane@purdue.edu, William Crossley, Isaac Tetzloff

NASA-sponsored studies are investigating an "N+3 generation" supersonic aircraft that might enter service in 2030 - 2035. Our presentation explores how this new aircraft affects fleet-level CO2 and NOx emissions based on projected operations and passenger demand in 2050. The study also examines the evolution of the overall productivity of the fleet (measured in passengers per block hour) as the aircraft penetrates the airline market and affects allocation of other aircraft.

3 - Sustainable Manufacturing

Niloofar Salahi, Graduate Student, Rutgers State University, Department of Industrial & Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, nsalahi@eden.rutgers.edu, Mohsen Jafari, Niloufar Sadat Mirhosseini, Amir Ghafoori

This paper addresses questions on sustainable production. Ecological and energy values are not considered in current pricing method. A product may be energy efficient in the usage stage of its lifecycle, but may not be so in manufacturing or other stages. This paper will introduce a method (based on a tree structure with nodes representing the energy consumption over various stages of product's lifecycle) to define a metric for energy footprint for manufactured products.

4 - Environmental Impact of Technology Improvements of Aircraft and Operational Changes of Airlines

Muharrem Mane, Purdue University, 701 W Stadium Ave, West Lafayette, In, 47907, United States of America, mane@purdue.edu, William Crossley

This study combines aircraft modeling and resource allocation to measure the environmental impact of improvements in aircraft technology and of changes in operations of airlines. The resource allocation aims to maximize airline profits while considering emissions and operational cost of individual aircraft. Tradeoff studies estimate the necessary improvement in technology to maintain emission-neutral operations in future years as well the cost of exceeding current emission levels.

5 - Sustainable Production and Consumption: Introduction to the Concept of Metrics From a Lifecycle Perspective

Niloofar Salahi,Graduate Student, Rutgers State University, Department of Industrial & Systems Eng, 96 Frelinghuysen Road, Piscataway NJ 08854, United States of America, nsalahi@eden.rutgers.edu, Amir Ghafoori, Mohsen Jafari, Niloufar Sadat Mirhosseini

This paper addresses questions on sustainable production. Ecological and energy values are not considered in current pricing method. A product may be energy efficient in the usage stage of its lifecycle, but may not be so in manufacturing or other stages. This paper will introduce a method (based on a tree structure with nodes representing the energy consumption over various stages of product's life-cycle) to define a metric for energy footprint for manufactured products.

■ WD35

H-Sapphire A, Fourth Floor

Modeling and Analysis in Healthcare Systems

Sponsor: Health Applications

Sponsored Session

Chair: Bo Zeng, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, Fl, 33620, United States of America, bzeng@eng.usf.edu

1 - Chemotherapy Operations Planning and Scheduling

Ayten Turkcan, Purdue University, Regenstrief Center for Healthcare Eng., West Lafayette, IN, 47907, United States of America, aturkcan@purdue.edu, Mark Lawley, Bo Zeng

The chemotherapy operations planning and scheduling in oncology clinics is a complex problem due to several factors such as cyclic nature of chemotherapy treatment plans, high variability in resource requirements and multiple clinic resources. In this study, we propose mathematical programming models to minimize the deviation from optimal chemotherapy treatment plans (in order to achieve the best health outcomes) while considering the limited availability of clinic resources.

2 - Hospital Inpatient Bed Capacity Planning

Shengyong Wang, Assistant Professor, The University of Akron, Mechanical Engineering Department, ASEC Room 101, Akron, OH, 44325-3903, United States of America, wangs@uakron.edu

Hospital bed capacity planning has been one of the major challenges for healthcare decision makers. To better understand patient flow, patient pathways were constructed by analyzing data and identifying the patients' critical path based on their length-of-stay and flow volume. The complex nature of inpatient flow was captured in a simulation model, which was then combined with the analysis of patient pathways to identify the nursing units that would need additional capacity in the future.

3 - Dynamic Ambulance Realocation Model

Bo Zeng, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, Fl, 33620, United States of America, bzeng@eng.usf.edu, Anahita Hassanzadeh, Shengyong Wang

We develop an ambulance relocation model in the dynamic environment. This model extends existing coverage models by including some practical consideration on the operations of ambulance relocation. Computational results will be presented to show the effectiveness of the model.

4 - A Model for the Evaluation of Patient Safety Interventions

Laila Cure, Doctoral Student, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620-5350, United States of America, lncure@mail.usf.edu, Jose Zayas-Castro

Patient safety is a priority in healthcare delivery. Normally specific needs are addressed through interventions, e.g. patient safety practices. Yet these interventions may trigger unknown risks. Concurrently system's performance evaluation is limited due to the dynamic nature of the health care processes. We propose a risk learning model to evaluate and monitor intervention effectiveness. The model accounts for human, technical and organizational factors, ideally using available data sources.

■ WD36

H-Sapphire B, Fourth Floor

Operations Research in Preventive Healthcare and Public Policy

Sponsor: Health Applications

Sponsored Session

Chair: Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, ruben.proano@rit.edu

1 - Strategy of Implementing NPIs to Mitigate an Influenza Pandemic

Feng Lin, Weldon School of Biomedical Engineering, Purdue University, 206 S. Martin Jischke Drive, West Lafayette, IN, 47907-2032, United States of America, linf@purdue.edu, Mark Lawley, Kumar Muthuraman

NPIs are the first line of defense against pandemic influenza. These interventions dampen virus spread by reducing contact between infected and susceptible persons. Because they curtail essential societal activities, NPIs must be applied judiciously. We use an epidemiologic compartmental model to develop optimal triggers for NPI implementation with an objective is to minimize the expected person-days lost from influenza related deaths and NPI implementations.

2 - A Predictive Model for Outcomes Associated with Smoking Cessation Interventions

Odette Reifsnider, Clemson University, 110 Freeman Hall, Clemson, SC, 29631, United States of America, osaleeb@clemson.edu, Maria Mayorga

We consider the impact of different pharmacologic interventions for smoking cessation in achieving long-term abstinence from cigarette smoking or a prolonged decrease in the amount of cigarettes smoked in pack-years. We design and develop a predictive model that estimates health and economic outcomes associated with smoking cessation interventions using discrete-event simulation.

3 - Using Simulation Optimization to Construct Efficient Screening Strategies for Cervical Cancer

Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W. Main Street, Box 843083, Richmond, VA, 23084, United States of America, lamclay@vcu.edu, Chris Foufoulides

Cervical cancer is the second most common type of cancer in women worldwide. Screening is of central importance towards combating cervical cancer. We apply simulation optimization to construct efficient screening strategies for cervical cancer by properly timing the screenings. The constructed strategies are highly cost-effective when a small number of lifetime screenings is available, and are more cost-effective than screening strategies used in practice.

4 - Choosing Screening Assays for Infectious Agents to Reduce Risk in Red Blood Cell Transfusion

Shiguang Xie, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, ryanxie@vt.edu, Ebru Bish, Douglas Bish, Anthony Slonim

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 specificity and sensitivity. We characterize the structure of an optimal solution under various conditions, propose effective heuristics and lower bounds, and test our heuristics using real-life data obtained from Red Cross.

5 - The Combination Vaccine Pricing Problem

Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, rpmeie@rit.edu, Sheldon Jacobson, Edward Sewell

This study defines combination vaccines as bundles of antigens that can be priced as a single item, and formulates an optimization problem that determines the best bundle allocation between vaccine producers and different countries, under a price discrimination agreement. Results show that for a given allocation of combination vaccines, there could be a set of prices at which vaccine producers and countries can commit without sacrificing coverage or the economic benefit for both parties.

■ WD38

H-Sapphire D, Fourth Floor

Inventory Management using Advance Supply Information

Cluster: Inventory Management
Invited Session

Chair: Jan Fransoo, Professor, Eindhoven University of Technology, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, J.C.Fransoo@tue.nl

1 - Supply Chain Management with Advance Supply Information

Mehmet Altug, Columbia University, 3022 Broadway Uris Hall, New York, NY, 10027, United States of America, maltug10@gsb.columbia.edu, Alp Muharremoglu

We consider a manufacturer who gets "advance supply information" from its supplier in the form of capacity availability forecasts for a given rolling information horizon. In each period, an updated capacity forecast vector is provided by the supplier. We model the evolution of these forecast vectors via the Martingale Method of Forecast Evolution. We show that state dependent base stock policies are optimal for the manufacturer. We develop easily computable and implementable heuristic policies.

2 - Optimal Inventory Control with Advance Supply Information

Marko Jaksic, Faculty of Economics University of Ljubljana, Kardeljeva ploscad 17, Ljubljana, Slovenia, marko.jaksic@ef.uni-lj.si, Jan Fransoo

We study a periodic-review inventory system under stochastic demand and stochastic limited supply capacity. However, the resulting uncertainty of the orders in the pipeline can be lowered through acquiring the advance supply information (ASI) about their actual realizations. We characterize the structure of the optimal ordering policy, perform a numerical analysis to quantify the value of ASI and obtain useful managerial insights.

3 - Warranty Inventory Optimization and Advance Supply Information

John Khawam, Stanford University, Stanford, CA, 94305, jkhawam@stanford.edu, Warren Hausman

In warranty inventory management, customers return malfunctioning products to a company for replacement or credit. These defective units may be recovered through testing and/or remanufacturing. First, we minimize remanufacturing costs and then formulate dynamic programs and heuristic dynamic programs in order to minimize system holding and penalty costs.

4 - Optimal Rationing and Ordering Policies under Advance Capacity Information

Esra Cinar, PhD Candidate, Bogazici University, Industrial Engineering Department, Bebek, Istanbul, 34342, Turkey, cinare@boun.edu.tr, Refik Gullu

We consider a system with multiple customer classes which are distinguished by the penalty costs charged for the unsatisfied demand. Available capacity in a period is random and the advance capacity information (ACI) for a number of planning periods is available at the time of ordering decision. We show the optimality of an ACI dependent base-stock policy and characterize the optimal rationing of available inventory. We also provide a computational study for illustrating the benefits of ACI.

■ WD39

H-Sapphire E, Fourth Floor

Operations Economics

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Martin Lariviere, Kellogg School of Management, Northwestern University, Evanston, IL, 60091, United States of America, m-lariviere@northwestern.edu

1 - A Service Marketplace with Multiple Classes and Multiple Skilled Agents

Eren Cil, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, e-cil@kellogg.northwestern.edu, Achal Bassamboo, Gad Allon

We consider a service marketplace in which customers have different service needs. Each customer can be served by either a group of agents specialized to cater particular needs of that customer or a general pool of agents who can handle any requests but not as competently as the specialized agents. We analyze how the self-interested customers choose between the dedicated and the general service, and characterize the response of the agents in the general pool to the customers' choices.

2 - Pre-order Policies When Consumers are Strategic

Pnina Feldman, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, pninaf@wharton.upenn.edu, Gerard Cachon

A pre-order is an order placed for a product which has not yet been released. Allowing pre-orders has been shown to be a good policy for the firm, because it can improve its demand information and order accordingly. We examine whether this continues to hold when consumers are strategic.

3 - Competition in the Fast Food Industry: An Empirical IO Study Using Structural Estimation

Margaret Pierson, Columbia University, Uris Hall, 2960 Broadway, New York, United States of America, mpp2002@columbia.edu, Gad Allon, Awi Federgruen

A series of theoretical models were recently proposed to analyze a general market for competing service facilities. Firms differentiate themselves by price and waiting time, as well as attributes not determined directly by competition. All contributions to the literature on service competition are theoretical, with numerical work confined to hypothetical examples. We conduct an empirical study testing the extent to which waiting time performance measures impact market share and price decisions.

■ WD40

H-Sapphire H, Fourth Floor

Supply Chain Management: Innovative Production Systems and Asymmetric Information

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Terry Taylor, Associate Professor, Haas School of Business, U.C. Berkeley, Berkeley, CA, 94611, United States of America, taylor@haas.berkeley.edu

1 - Supply Chain Collaboration Under Information Asymmetry

Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Sang-Hyun Kim

Firms often collaborate during the early product design stage in order to achieve benefit of production cost reduction. We analyze how firms' incentives to collaborate are impacted by asymmetric information and uncertainties in demand and cost, and which contracting strategies are optimal under different conditions.

2 - Does a Manufacturer Benefit From Selling to a Better-forecasting Retailer?

Wenqiang Xiao, New York University, 44 W 4 St., KMC 8-72, New York, NY, 10012, United States of America, wxiao@stern.nyu.edu, Terry Taylor

A manufacturer sells to a retailer with private demand-forecast information. We show that the manufacturer's profit is convex in the retailer's forecasting accuracy: The manufacturer benefits from selling to a better-forecasting retailer if and only if the retailer is already a good forecaster. If the retailer has poor forecasting capabilities, then the manufacturer is hurt as the retailer's forecasting capability improves.

3 - The Value of Fast Fashion: Rapid Production, Enhanced Design, and Strategic Consumer Behavior

Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, swinney_robert@gsb.stanford.edu, Gerard Cachon

We investigate the value of so-called "fast fashion" production systems, which combine reduced production leadtimes and enhanced product design efforts capable of capturing the latest consumer trends. In particular, we consider whether the two aspects of fast fashion systems (rapid production and enhanced design) are complements or substitutes, and we analyze the impact of fast fashion production on forward-looking (or strategic) customer purchasing behavior.

■ WD41

H-Sapphire L, Fourth Floor

OR and Litigation Support

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Mark Lutz, Department of Homeland Security, 9055 Loreleigh Way, Fairfax, VA, 22031, United States of America, mlutz@live.com

Discussant: Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale VA 22003, United States of America, samuelsondoug@yahoo.com

1 - Use of OR Methods in Construction Litigation

Gerry Williams, President, Construction Research, Inc., 1822 SW Madison Street, Portland, OR, 97205, United States of America, gerry@cemresearch.com

For many years experts and so-called experts have presented their opinions in construction disputes. Increasingly, in the post Daubert era, these "opinions" have been challenged, particularly if they are not grounded in the proper "science." This presentation will discuss OR methods used in recent construction disputes and present a case study of an "Allocation of Fault" analysis using AHP.

2 - Informing the Findings of Truth and Reconciliation Commissions

Jana Asher, Executive Director, StatAid, 1111 Jackson Avenue, Takoma Park, MD, 20912, United States of America, asher@stataid.org, Michael Kisielewski

A Truth and Reconciliation Commission determines who did what to whom after civil unrest by analyzing of a complex system of inter-related violations that can span years and geography. In this talk, we describe work for the TRCs of Sierra Leone, Peru, and East Timor. We compare and contrast the data and mathematical models used: basic statistics, survey estimates, and multiple systems estimation. We also discuss difficulties in data acquisition and politics of working within the TRC environment.

3 - The Impact of Expert Testimony

Mark Lutz, Department of Homeland Security, 9055 Loreleigh Way, Fairfax, VA, 22031, United States of America, mlutz@live.com

The impact of expert testimony varies widely. A case can be won or lost because a jury believed an expert. A jury verdict can be rejected on appeal because the trial judge ruled incorrectly on how an expert's testimony was to be analyzed. A properly prepared expert can be instrumental in winning a case, and a poorly prepared expert can lose a case. In this presentation, I will explain how expert testimony is analyzed in pre trial proceedings, at trial, and on appeal.

■ WD42

H-Sapphire P, Fourth Floor

Supply Chain Management III

Contributed Session

Chair: Hiram Moya, PhD Student / Research Assitant, Texas A&M University, 2807 Henry Ct., College Station, TX, 77845, United States of America, hiram@tamu.edu

1 - Feasibility and Evaluation of a Freight Village

Maria Boile, Associate Professor, Rutgers University, 100 Brett Road, Piscataway, NJ, 08854, United States of America, boile@rci.rutgers.edu

A freight village (FV) is a fusion of land use and transportation planning which clusters industrial activity around a concentration of shared transportation infrastructure. A generic model is developed to evaluate the impacts of the establishment of a FV, taking under consideration the nature of businesses located inside the FV, the interrelationships of businesses located inside and outside the FV and the principles of layout arrangement in relation to transportation modes accessibility.

2 - Models and Algorithms for Pack Optimization Problem

Pu Wang, Research Assistant, Edward P. Fitts Department of Industrial and Systems Engineering, North Carolina State University, Daniels 443, North Carolina State University, Raleigh, NC, 27695, United States of America, pwang4@ncsu.edu, Shu-Cherng Fang, Tao Hong

Merchandise is commonly pre-packed for easier handling in the supply chain. Pack optimization is to provide the optimal pack order quantities to match store-level demand meanwhile minimizing costs. An IP model and a DP model are presented, which provide some intuition on solving the problem; however, exact solution is not achievable for large-scale problems in most cases. A heuristic is developed and the computational results show that it can generate reasonable solutions quickly.

3 - Are the Incentives in Your Supply Chain Aligned?

Johan Lundin, PhD Candidate, Lund University, Box 118, Lund, SE-22100, Sweden, johan.lundin@tlog.lth.se

This paper expounds on incentives (risks, costs, and rewards) in a supply chain context using network flow modeling. Data from the Swedish cash supply chain illustrates how misaligned risks and costs can be counterbalanced using reward sharing between members of the supply chain in order to improve its performance.

4 - Single Border Crossing Point of Entry (POE) Modeling & Analysis

Hiram Moya, PhD Student / Research Assitant, Texas A&M University, 2807 Henry Ct., College Station, TX, 77845, United States of America, hiram@tamu.edu

For member's states of NAFTA, the economy moves freight by trucks. After 9/11, the specific problem is to find a balance between sustainable security levels, operational cost, and throughput of goods at the POE. The approach is to use simulation with empirical data and analytical tools to characterize the as-is situation. Then use Congestion-Based policies and other methodology suggestions to evaluate test scenarios. The objective is to look for metric improvements, with sustained security.

■ WD43

H-Room 400, Fourth Floor

Dual Channel Strategies in SCM

Contributed Session

Chair: Vijayendra Viswanathen, Dorctoral Student, Univeristy of Wisconsin-Milwaukee, 2466 N Oakland Ave., Apt. 128, Milwaukee, WI 53211, United States of America, viswana2@uwm.edu

1 - Value of Dual Sales Channel Strategy in Countering Speculation

Tianke Feng, University of Florida, 323 University Villiage Apt 8, Gainesville, FL, 32603, United States of America, fengtk@ufl.edu, Amar Sapra, Joseph Geunes

One interesting outcome of E-Commerce has been the emergence of speculators. Speculators create shortages of popular products (e.g., toys) by removing them from store shelves in hordes and selling them at inflated prices on sites such as eBay. This work examines the impact of speculation on ordering decisions in a two-stage, manufacturer-retailer supply chain. We also analyze when it is profitable for the manufacturer to also sell on eBay and thus compete directly with speculators.

2 - When is Adopting Online Channel Beneficial to Clicks-and-mortar Retailers

Zhong Wen, Tsinghua University, School of Economics and Management, 438 Weilun, Beijing, 100084, China, wenzh@sem.tsinghua.edu.cn

The Internet has provided traditional retailers a new channel to encroach their competitors' customer bases. In this paper, we study traditional brick-and-mortar retailers' incentives to set up their online storefronts in a duopoly setting and how this strategic move affects market prices and firm profits. We show that clicks-and-mortar is indeed the equilibrium channel structure, but the profit impact for the retailers may depend on the competitiveness of the offline market.

3 - Strategic Inventories in a Differentiated Cournot Duopoly with Vertical Control

Vijayendra Viswanathan, Doctoral Student, University of Wisconsin-Milwaukee, 2466 N Oakland Ave Apt 128, Milwaukee, WI, 53211, United States of America, viswana2@uwm.edu, Jaejin Jang

This paper explores the role of strategic inventory in a two-echelon supply chain consisting of one-manufacturer supplying a key component to a two value-adding retailer - differentiated Cournot Duopoly, downstream. Preliminary results show that competition induces retailers to carry more strategic inventory and leads to a regime of higher retailer wholesale prices.

■ WD44

H-Room 402, Fourth Floor

Service Resource Management: Theory and Application

Sponsor: Service Science

Sponsored Session

Chair: Zhaowei Miao, Associate Professor, Xiamen University, NO.422, Siming South Road, Siming District, Xiamen, 86, 361005, China, miaozhaowei@gmail.com

Co-Chair: Fan Wang, Associate Dean & Professor, School of Business, Sun Yat-sen University, 135 West Xingang Road, Guangzhou, 510275, China, fanwang@gmail.com

1 - Periodic Service Quality for Software as a Service

Qi Fei, HKUST, Hong Kong,alexfeiqi@gmail.com

Recently a revolution of online delivery of software, called as software-as-a-service, occurred in the enterprise software industry and provided a solution to the dilemma. Software-as-a-service is a software application delivery model. To study the cost and revenue structure as well as the decision process, We formulate the problem as a stochastic dynamic programming and demonstrate that a list quality policy is optimal.

2 - Optimal Inventory Decisions for a Multi-product Assemble-to-Order System

Ke Fu, Associate Professor, Lingnan College, Sun Yat-sen University, 135 Xingang Xi Road, Guangzhou, 510275, China, fuke@mail.sysu.edu.cn

We consider inventory and production decisions for an assemble-to-order (ATO) system with multiple products and limited assembly capacity. A contract manufacturer needs to determine the stocking quantities for the components prior to the confirmation of the uncertain demands. The competition of capacity among products further complicates the decision. We explore special structures of the above ATO problem and propose efficient solution procedures.

3 - Software-as-a-Service Economics: Democratization and Monetization

Harry Katzan, Professor, Savannah State University, 202 Landing Lane, Bluffton, SC, 29909, United States of America, katzanh@hargray.com

Software-as-a-Service (SaaS) has been defined as software deployed as a hosted service and accessed over the Internet. This paper covers the democratization and monetization of software services and uses cloud computing as the primary delivery vehicle. Cloud computing represents a contextual shift in how computers are provisioned and accessed. Opportunity and value exists in software-as-a-service for providers and clients, and the economic and technical essentials are reviewed in this paper.

4 - Resource Allocation with Uncertain Demand and Price, with Application to Fleet Management Problem

Haiqing Song, Dr., Sun Yat-Sen University, Lingnan College, No. 135, Xingang Xi Road, Guangzhou, 510275, China, songhq@mail.sysu.edu.cn, Huei Chuen Huang

This paper studies the dynamic vehicle allocation problem with both uncertain demands and uncertain prices (costs). We model this problem with a multistage stochastic network with random arc capacities and costs. We then provide an approximate dynamic programming method solve it.

■ WD45

H-Room 410, Fouth Floor

Innovation Management

Contributed Session

Chair: Masataka Yamada, Kyoto Sangyo University, Kyoto, 603-8555, Japan, myamada@cc.kyoto-su.ac.jp

1 - The Brave New World of Entrepreneurship in Immersive Virtual Environments

Jing Wang, University of New Hampshire, Decision Science Department WSBE, University of New Hampshire, Durham, NH, 03824, United States of America, jing.wang@unh.edu, Devkamal Dutta, Kholekile Gwebu

In the real world, how and why nascent organizations form has been extensively studied. But emergence of virtual organizations within immersive virtual environments such as Second Life is only now engaging the attention of management researchers. In this study, we seek to understand to what extent the Big-5 personality traits and contextual factors such as perceived desirability and feasibility of entrepreneurial actions affect the intention to create a virtual new venture.

2 - The Innovation Strategy of Complementors of Platforms and Technology Ecosystems

Ray Fung, Harvard Business School, Soldiers Field Park Campus, Morris F156, Boston, MA, 02134, United States of America, rfung@hbs.edu

Much of the past literature of two-sided networks concentrates on the role of the platform as the enabling element that mediates a technology ecosystem. However, the role of the platform complementors is equally important to the behavior of the ecosystem as a whole. Furthermore, much of the past work concentrates on static equilibrium outcomes, but says relatively little about the dynamics of the evolution of an ecosystem over time. I present emipirical evidence of the complementor behavior from one technology ecosystem that is actively evolving today.

3 - Consumer Innovativeness and Forecasting of Innovation Adoption Behavior with Survival Analysis

Masataka Yamada, Kyoto Sangyo University, Kyoto, 603-8555, Japan, myamada@cc.kyoto-su.ac.jp, Toshihiko Nagaoka

This study investigates first the structure of consumer innovativeness, specifically of its conceptual aspect and behavioral aspect as in Midgley and Dowling (1978). Then adoption of innovation is considered as a resulting innovative behavior of the conceptual consumer innovativeness. Finally consumer's adoption timing and its probability are forecasted by a survival function with self reported innovativeness score, pre-adoption strong feeling of moved score, etc. on iPod adoption data.

■ WD46

H-Room 411, Fourth Floor

Student Paper Session: MOTI

Sponsor: Technology Management
Sponsored Session

Chair: Fred Phillips, Professor, Maastricht School of Management and Alliant International University, 10622 Sunset Ridge Dr., San Diego, ca, 92131, United States of America, fphillips@alliant.edu

1 - Understanding Corporate Social Responsibility (CSR): A Case Study in Gold Mining Operations in Peru

Ana Maria Vidal Cobian, Doctoral Student, Pontificia Universidad Catolica de Lima - CENTRUM, Tacna 365 Lima 32 Peru, Alomias Robles 125, Los Alamos de Monterrico Surco, 33, Peru, avidalcobian@hotmail.com, Oscar Aliaga

The topic of Corporate Social Responsibility (CSR) is examined through this case-study of a modern gold mining operation in Peru. Using the Stakeholders theory as a framework, managers and social leaders were interviewed revealing different understandings and approaches to CSR. The study aims to contribute to the discussions for international certification of CSR.

2 - Price and Advertising Decisions Throughout the Innovation Diffusion Process in an Oligopolistic Mark

Daniel T. Eloi Santos, Doctoral Student, Federal University of Minas Gerais, Rua Sagitario, 232, Santa Lucia, Belo Horizonte, MG, 30360230, Brazil, daniel.eloi@pris.com.br, Leonardo Santiago

Our research considers the problem of pricing and advertising strategies for new products facing high competition during their lifecycle. We analyze four scenarios, considering pricing and advertising decisions and illustrate our model with an empirical example. We then discuss the case in which pricing and advertising decisions are made simultaneously, leading to a predatory competition.

3 - Determinants of Foreign Direct Investment Using Gravity Model Approach

Hoang T. Nguyen, Doctoral Student, Maastricht School of Management and Alliant International University, Dorpstraat 66, Maastricht, 6227 BP, Netherlands, nguyenth@msm.nl, Geert Duysters, Harald Sander, James Patterson

The aim of this paper is to study the determinants of foreign direct investment. By applying the gravity model and based on the UNCTD methodology for ranking a country's inward FDI potential, we concurrently examine the impact of the push and pull driving force from source and recipient country. The evidence shows that both the host and home country characteristics influence the FDI inflows on the aspect of market conditions, cost of production, local business conditions, and government policy

4 - Inflection Points and Industry Change: Was Andy Grove Right After All?

Joy Limprayoon, Doctoral Candidate, Alliant International University, 10455 Pomerado Rd., Marshall Goldsmith School of Management, San Diego, CA, 92131, United States of America, plimprayoon@alliant.edu, G. George Hwang, Fred Phillips

We examine whether the "strategic inflection points" described by former Intel CEO Andy Grove correspond to mathematical inflection points in the product/technology life cycle. We find one sense in which they do and two senses in which they do not. Managerial implications prove to be extensive and profound.

■ WD47

H-Room 412, Fourth Floor

Marketing III

Contributed Session

Chair: Justin Azadivar, University of California-Berkeley, Department of IEOR, Berkeley, CA, 94704, United States of America, jazad@berkeley.edu

1 - Relational Contracts in Franchising

Matthias Fahn, University of Munich, Kaulbachstrasse 45, Munich, 80539, Germany, matthias.fahn@lrz.uni-muenchen.de

A relational contracts model of franchising with many agents and where reneging is not observable by the market analyzes the incentives of franchisees to invest into the franchisor's reputation. Termination costs of a franchising relationship are used as a commitment device to extract rents. Uncertainty concerning the profitability makes the principal less willing to franchise if expected profits are high, which is in line with current empirical findings.

2 - A Cross Functional Framework For Marketing, Production, And Design Coordination

Jerry Behar, Student, University of NY at Buffalo, 438 Bell Hall, Buffalo, NY, 14260-2050, United States of America, Jbehar7106@aol.com, Rakesh Nagi, Bahattin Koc

This paper links and quantifies the inter-related impacts of product design, manufacturing costs and capacities, market characteristics, and investment decisions on profit using multiplayer competitive game theory. A cross functional, cross product, and cross market tool enables managers to quantify and maximize overall system profit under various conditions. We show how integration of these functional disciplines is critical in quantifying and optimizing overall profit.

3 - Co-operative Advertising in a Dynamic Retail Market Duopoly

Anshuman Chutani, School of Management, The University of Texas at Dallas, SM 30, Box 830688, Richardson, TX, 75083-0688, axc059000@utdallas.edu

We consider a case of retailer duopoly where the retailer(s) are supported by the manufacturer in their advertising costs. A Nash game takes place between the retailers competing for market share and a Stackelberg game between the retailers and the manufacturer. The manufacturer announces his share in advertising and the retailers in response choose their optimal advertising strategies. We provide the optimal advertising policy for the retailers in feedback form and obtain the condition when co-operative advertising is optimal for the manufacturer in various sub cases.

4 - How One Purchase Bridges Another Purchase: Market Structure Analysis by Network Analysis

Hiroshi Kumakura, Professor, Senshu University, 2-1-1, Higashi-mita, Tama-ku, Kawasaki, Japan, kumakura@isc.senshu-u.ac.jp

By recognizing products/brands as dots, and purchase among products as links in network analysis, we discussed market structure. At this time, we analyzed how previous purchase bridges/crosslinks other later purchase, with the structuralism assumption that purchase a product are caused under the relationship between that product and others.

5 - Competitive Dynamic Capacitated Facility Location under Satsifaction-dependent Demand

Justin Azadivar, University of California-Berkeley, Department of IEOR, Berkeley, CA, 94704, United States of America, jazad@berkeley.edu, J. George Shanthikumar, Max Shen

We examine dynamic facility location under competition where demand varies over time in response to customer service and loyalty.

■ WD48

H-Sapphire Green Room, Fourth

Innovations in Healthcare Service Operations

Cluster: Service Operations Management
Invited Session

Chair: Craig Froehle, University of Cincinnati, 2925 Campus Green Dr, Cincinnati, OH, 45221-0130, United States of America, craig.froehle@uc.edu

1 - Are Threshold Policies Sufficient for the Optimal Timing of HIV Treatment?

Matt Bailey, Assistant Professor, Bucknell University, School of Management, Taylor Hall, Lewisburg, PA, 17837, United States of America, matt.bailey@bucknell.edu, Steven Shechter, Andrew Schaefer

The question of when to initiate HIV therapy is considered the most important question in HIV care today. We present a Markov decision process approach to optimal therapy initiation as a function of a patient's two primary prognostic variables: CD4 count and viral load. We prove that restricting attention to threshold policies is optimal under clinically reasonable assumptions. Furthermore, we establish necessary and sufficient conditions for the optimality of immediate treatment.

2 - Designing Healthcare Operations to Improve Patient Experience

Sriram Dasu, University of Southern California, BRI 401U, Los Angeles, CA, 90089, United States of America, Dasu@marshall.usc.edu

This presentation describes how patient interactions and process flows can be systematically changed to improve patient experiences. The study will present findings from two studies. One study deals with chronic care patients and the other with ob/ gyn patients.

3 - Mitigating the Operational Effects of Interruptions and Forgetting in Radiology

Craig Froehle, University of Cincinnati, 2925 Campus Green Dr, Cincinnati, OH, 45221-0130, United States of America, craig.froehle@uc.edu, Denise White

Interruptions hamper knowledge-intensive work by inducing forgetting and rework. To address this, we test a sequestering policy, where a resource is protected from interruptions. By observing radiologists, we gathered interruption data, which served as an input to a simulation model. We found sequestering benefits to depend on production delay costs and forgetting rates. If interruption-induced forgetting is not explicitly considered, sequestering benefits are underestimated.

■ WD49

H-Room 300, Third Floor

OR Models for Workforce Management

Contributed Session

Chair: Ada Barlatt, Assistant Professor, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, abarlatt@uwaterloo.ca

1 - Staffing Optimization in Multi-partners Service Proposals

Hua Ni, IBM, 3903 Carroll Ct., Chantilly, VA, 20151, United States of America, huani@us.ibm.com, Leanne Viera, Mary Helander

In multi-partners service proposal efforts, the staffing decisions can be complicated due to factors such as vendor agreements, government regulations, and contractual constraints. In this talk, we will present our approach in addressing this problem using integer program models and discuss our experience in applying this approach in several proposal efforts of IBM Global Business Services.

2 - The Timing of Staffing Decisions for a Virtual Call Center

Matthew Keblis, Assistant Professor, University of Wyoming, College of Business, Laramie, WY, 82071, United States of America, mkeblis@uwyo.edu, William Stein, Ying Li

We propose an approach to tactical capacity planning at a call center consisting of some or all virtual agents who work from home. This enables management to delay making work commitments until the last minute when more accurate call volume forecasts are available. A call volume forecasting model based upon an AR model is used and its properties derived. Using DP we determine the optimal number of workers to hire on a continuing basis plus how many last minute flexible workers to use.

3 - Optimal Employment Policies with Learning and Forgetting in a Style Good Factory

Yufei Huang, Xian Jiaotong University, P.O. Box 2341, Xian Jiaotong University, Xian, 710049, China, favor.huang@gmail.com, Yingluo Wang

We study the optimal employment policies in a style good factory that minimize the total number of both experienced and new employees. We model this problem as a multi-period Newsvendor problem, and introduce the Learn-Forget Curve Model (LFCM) to investigate the optimal policies of firing and hiring during the period intervals. Theoretical results show that experience from previous production and the length of period intervals can significantly influence employment policies.

4 - Optimizing Worker Interaction When Considering Alternative Work Week Schedules

Arleigh Waring, University of Michigan, Department of Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, awaring@umich.edu, Ada Barlatt

Studies show alternative work weeks maintain productivity while increasing employee engagement. Despite this, companies may not implement alternative work weeks because of concerns regarding the decrease in face-to-face contact among employees. We present an approach to evaluate the tradeoffs between employee interaction time and work week schedules.

■ WD50

H-Room 302, Third Floor

Production and Scheduling I

Contributed Session

Chair: Susan Slotnick, Associate Professor, Cleveland State University, OMS Dept, BU 542, 2121 Euclid Avenue, Cleveland, OH, 44115, United States of America, s.slotnick@csuohio.edu

1 - An Advanced Production Planning and Scheduling (APPS) Framework for Batch Process Production Systems

Hamdy Elwany, Professor, Alexandria University, 678 El Horreya Ave, Alexandria, Egypt, alaa@elwany.com, Nagham El-Breshy

We propose an advanced production planning & scheduling (APPS) framework to address production and scheduling decisions sequentially in batch process production systems. A linear programming (LP) model is first formulated to obtain the optimal Master Production Schedule (MPS). This is then input to another LP model to determine the optimal Operations Schedule (OS). The proposed framework is validated using real-world data from a world leading manufacturer of fast moving consumer goods (FMCG).

2 - Integration of Order Quotation and Production Scheduling

Liang Lu, HKUST, HKUST, Academic Building, 5567, Kowloon, Hong Kong, Hong Kong - PRC, nicowish@gmail.com, Xiangtong Qi

We studied the integration of order quotation and production scheduling for a manufacturing company. Two models, static and dynamic quotatation models are considered. Quotation strategy and some interesting results are identified.

3 - Time Representations and MILP Models for Process Scheduling Problems

Sylvain Mouret, PhD Candidate, Carnegie Mellon University, 4705 Fifth Avenue, Apt 2G, Pittsburgh, 15213, United States of America, sylvain.mouret@gmail.com, Pierre Pestiaux, Ignacio Grossmann

Many different scheduling MILP models have been proposed in the chemical industry that rely on different time representations. In this work, we study the differences between four major time representations (Floudas and Lin 2004, Mouret et al. 2009) and their mathematical models. We show that better understanding can be achieved when choosing MILP models for specific scheduling problems by first testing and selecting the most adequate time representation.

4 - Lead-time Quotation for an Integrated Steel Mill

Susan Slotnick, Associate Professor, Cleveland State University, OMS Dept, BU 542, 2121 Euclid Avenue, Cleveland, OH, 44115, United States of America, s.slotnick@csuohio.edu

This paper presents a model of lead-time quotation for an integrated steel mill, for which the bottleneck process requires a minimum batch size. Production time, time in the queue and waiting time for the minimum batch size must be considered when calculating delivery promise dates. A computational study demonstrates how the steelmaker can take into account order characteristics when determining lead times.

■ WD51

H-Room 303, Third Floor

Decomposition Methods for Integer Programming II

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)

Sponsored Session

Chair: Matthew Galati, Optimization Interface Lead, SAS Institute, Philadelphia Regional Office, Suite 201, 1400 Morris Drive, Chesterbrook, PA, 19087, United States of America, matthew.galati@sas.com

1 - An Analytic Center Benders Decomposition Branch-and-cut Algorithm for Structured Integer Programs

Joe Naoum-Sawaya, University of Waterloo, 200 University Ave. West, Waterloo, ON, N2L3G1, Canada, jnaoumsa@engmail.uwaterloo.ca, Samir Elhedhli

We present the integration of the Analytic Center Cutting Plane Method (ACCPM) in Benders decomposition. Unlike the classical Benders decomposition where cuts are generated using extreme points, Benders cuts are generated from a central point of the master problem. A branch-and-cut approach is used to implement the ACCPM based Benders decomposition. Computational results on the capacitated facility location problem show that our algorithm outperforms the classical Benders decomposition.

2 - Accelerate Benders Method Using Multiple Constraints Generation

Georgios K.D. Saharidis, Senior Research Associate, Center for Advanced Infrastructure and Transportation, Rutgers - The State University of NJ, 100 Brett Road, Piscataway, NJ, 08854, United States of America, saharidis@gmail.com, Michel Minoux, Marianthi G. Ierapetritou

Over the years, various techniques have been proposed to speed up the classical Benders decomposition algorithm. We present a new strategy to speed up Benders method which is shown to implement with a novel way the multiple constraints generation idea. Two case studies are used in order to evaluate the efficiency of the proposed strategies.

3 - Cutting-plane Algorithm for Robust Linear Optimization with Recourse

Tara Terry, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, tlterry0825@mac.com, Aurelie Thiele, Marina Epelman

We study robust linear optimization with recourse, with unknown parameters modeled as belonging to a polyhedral uncertainty set, and the objective to minimize the sum of first-stage costs and worst-case second-stage costs. We propose a cutting-plane algorithm, with the separation problem solved via a simple sort procedure for problems with simple recourse, and a MIP for problems with general recourse. We present computational results and insights for problems with simple and general recourse.

■ WD52

H-Room 304, Third Floor

Pricing, Contracts and Channel Structure

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Sudheer Gupta, Associate Professor, Faculty of Business, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, sudheerg@sfu.ca

1 - Pricing Public Services Subject to Congestion: When and How Much?

George Zhang, Professor, Western Washington University, & Simon Fraser University, 516 High Street, Bellingham, WA, 98225, United States of America, gzhang@sfu.ca, Penfei Guo

Many public service systems such as health care, immigration service, transportation, and border-crossing systems are suffered from consideable congestions. In this research, we compare the two-tier pay-or-free service system with a single tier free service system and find the conditions wher the former one outperforms the latter one. Pricing and information effects are investigated in the comparisons.

2 - Don't Ask, Don't Tell: Revenue Sharing with Dishonest Retailers

Hans Sebastian Heese, Assistant Professor of Operations and Decision Technologies, Indiana University, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, hheese@indiana.edu, Eda Kemahlioglu-Ziya

Revenue sharing contracts are widely used to align the incentives of different channel members. Under a typical revenue sharing contract, if it is impossible or prohibitively expensive for the manufacturer to verify the retailer's sales reports, the retailer has incentive to underreport sales and cheat the manufacturer out of part of its profit. We develop a simple analytical model to investigate the impact of cheating on the different supply chain constituents.

3 - The Benefits of Upward Channel Decentralization

Yunchuan Liu, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth St., Champaign, IL, 61801, United States of America, liuf@illinois.edu, Rajeev Tyagi

Upward channel decentralization occurs when firms choose to not manufacture products by themselves, and procure products from upstream suppliers. We show that when product positioning is endogenous, upward channel decentralization incentivizes firms to differentiate their products more. With more differentiated products, the competition is softened at the downstream level, benefiting the downstream firms.

4 - Strategic Decentralization with Inventory Commitments

Sudheer Gupta, Associate Professor, Faculty of Business, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, sudheerg@sfu.ca, Harish Krishnan

We analyze strategic decentralization incentives in competing supply chains when firms face stochastic price sensitive demand and need to decide on both stocking levels and retail price. We show that decentralization leaves both manufacturers worse off. Moreover, we show that manufacturers have an incentive to control downstream inventories, while delegating the price decision to independent retailers. The latter provides a strategic explanation for vendor-managed inventories.

■ WD53

H-Room 305, Third Floor

Integer Programming Applications

Contributed Session

Chair: Carlos Oliveira, Princeton Consultants, 2 Research Way, Princeton, NJ, United States of America, coliveira@gmail.com

1 - Integer Programming Based Approaches to Parallel Replacement Problem under Technological Change

Esra Buyuktahtakin, Visiting Assistant Professor, University of Arizona, 1127 E. James E. Rogers Way, Engineering Building #20, Tucson, AZ, 85721, United States of America, esra@sie.arizona.edu, Joseph Hartman

We study the integer programming formulation of the parallel replacement problem under technological change. We provide optimal solution characteristics and insights about the economics of the problem. We propose cutting planes for strengthening the problem formulation and develop effective solution algorithms based on these cutting planes. Finally, we present computational results to illustrate the effectiveness of the proposed methods.

2 - A MINLP Model to Optimize the use of Aircraft Deicing and Anti-icing Fluids

Scott Ornitz, Civil Engineer, Florida Atlantic University, 777 Glades Road, Boca Raton, FL, 33431, United States of America, sornitz@fau.edu, Ramesh Teegavarapu, Evangelos Kaisar

A detailed study is proposed for optimizing the use of aircraft deicing and anti-icing fluids (ADAF)in airport operations. Mathematical optimization models (e.g. MINLP with binary variables) based on a variety of objectives are formulated, developed and applied to a case study which routinely carries out ADAF. Optimization formulations for optimal use of fluids under budgetary and environmental compliance constraints are used and results show the models to be robust.

3 - Scheduling in a Contaminated Area by Integer Programming

Tadeusz Sawik, AGH University of Science & Technology, Department of OR & IT, Al. Mickiewicza 30, Krakow, 30059, Poland, ghsawik@cyf-kr.edu.pl

A time-indexed integer program is proposed for scheduling jobs executed by a team of workers in an area contaminated with radio-active or chemical materials. The dynamics of the harmful factor and the norms of organism recovery imply that each work period for a job should be immediately followed by a rest period for the worker executing this job. The problem is modeled as a scheduling on unrelated parallel processors with start-time dependent processing times.

4 - From Gridded to Gridless Routing in VLSI Design

Tim Nieberg, Research Institute for Discrete Mathematics, University of Bonn, Lennestr. 2, Bonn, Germany, nieberg@or.uni-bonn.de

The VLSI routing problem is to connect pins within the chip area by wires so that they are electrically equivalent. Traditionally, this problem is solved on an incomplete 3-dimensional grid. However, as the feature size of ICs become ever smaller, grid-based approaches become harder to realize. A solution to this dilemma is a shift towards gridless design paradigms. We present such an approach and focus both on theoretical and practical aspects of the migration to gridless VLSI design.

5 - An Integer Programming Formulation for the Drayage Problem

Carlos Oliveira, Princeton Consultants, 2 Research Way, Princeton, NJ, United States of America, coliveira@gmail.com

The drayage problem in the trucking industry requires that a set of containers be used to serve pickup and delivery jobs. The goal of the problem is to minimize costs associated with usage and transportation of containers. The problem was modeled using integer programming techniques. We provide results from our recent experiments with the problem.

■ WD54

H-Room 306A, Third Floor

Compressed Sensing: Theory and Applications

Sponsor: Optimization/Networks
Sponsored Session

Chair: Rohit Khandekar, Research Staff Member, IBM T.J.Watson Research Center, 19 Skyline Drive, Elmsford, NY, 10532, United States of America, rkhandekar@gmail.com

1 - Combinatorial Compressive Sensing

Mark Iwen, University of Minnesota, Inst. of Math and its Applications (IMA), 400 Lind Hall, 207 Church Street S.E., Minneapolis, MN, 55455, United States of America, iwen@ima.umn.edu

I will review recent combinatorial compressed sensing results and techniques. The talk will begin with a discussion of the relationship between group testing matrix constructions, unbalanced expander graphs, and matrices with the l1 restricted isometry property. The remaining portion of the talk will focus on the application of these constructions to streaming algorithms for massive datasets, compressible image recovery, and general nonlinear approximation problems in signal processing.

2 - Sparse and Geometric Models for Signal Understanding From Compressive Measurements

Michael Wakin, Colorado School of Mines, Division of Engineering, 1500 Illinois St., Golden, CO, 80401, United States of America, mwakin@mines.edu

A core assumption in Compressive Sensing (CS) is that a signal has a sparse representation in some basis; this allows the signal to be recovered from a small number of random measurements. We will review the basic CS theory and then discuss alternatives to sparse models inspired by a geometric perspective. Of particular interest are manifold-based models for multi-signal ensembles. Using these models, we will discuss new methods for signal understanding from compressive measurements.

3 - A Near Linear Time Algorithm Iterative Algorithm for Sparse Recovery with RIP

Rahul Garg, IBM TJ Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, grahul@us.ibm.com

We present an algorithm for finding an s-sparse vector x that minimizes the square-error (y - Ax) when the matrix A satisfies the restricted isometry property, with isometric constant \delta_{2s} < 1/3. Our algorithm, called GraDeS iteratively updates x only using matrix-vector product computations. Our implementation of GraDeS outperforms previously proposed algorithms by an order of magnitude.

■ WD55

H-Room 306B, Third Floor

Auctions and Mechanism Design

Contributed Session

Chair: Milan Bradonjic, Los Alamos National Laboratory, MS B284, Los Alamos, NM, 87545, United States of America, bradonjic@gmail.com

1 - Optimal Bidding in Finite Horizon Sequential Auctions with Learning

Srinivasa Puranam, Rutgers Business School, 180 University Ave, Newark, NJ, 07102, United States of America, karti@pegasus.rutgers.edu, Michael Katehakis

Consider the problem of sequentially bidding in N auctions of identical items. It is assumed that at each auction there is a sufficiently high price that if paid the item is won. The objective is to acquire one of these items at minimum expected cost. We present properties of optimal bidding for cases where the opponents' bid distribution is known or it is partially known. In both cases we show that as the number of auctions remaining decreases the optimal bid increases

2 - Maximizing Taboo Rewards in Sequential Auctions

Michael Katehakis, Professor, Rutgers, 180 University Ave., Newark, NJ, 07102, United States of America, mnk@rci.rutgers.edu, Srinivasa Puranam

We consider the problem of sequentially bidding in N auctions of identical items everyday and the process repeated ad infinitum. It is assumed that the item once acquired is sold in a secondary market. The objective is to maximize the taboo first passage rewards. Here the taboo state is the state of not acquiring an item in a day. This paper explores the computation of the optimal bid for such a problem.

3 - Efficient Mechanism for Balanced Multiple Task Allocation in Multi-robot Systems

Subramanian Nachiappan, Associate Professor, Thiagarajar College of Engineering, Madurai, Madurai, 625015, India, sp_nachi@yahoo.com, Murugappan Elango

This paper proposes an efficient mechanism to allot multiple tasks to Multi-Robot systems. The allocation is done based on two objectives viz minimum total travel distance and equal sharing of load. Efficient mechanism clusters group of tasks and allocates the clusters to multiple robots using auction based mechanism. The results obtained using the proposed method is compared with benchmark dataset.

4 - Interpretation of Lagrange Multipliers in Nonlinear Pricing Problem

Kimmo Berg, Researcher, Systems Analysis Laboratory, Helsinki University of Technology, P.O.Box 1100, Espoo, 02015, Finland, kimmo.berg@tkk.fi, Harri Ehtamo

Nonlinear pricing is an application of mechanism design, which is a central problem in economics and game theory. The Lagrange multipliers in the pricing problem can be interpreted as a network of flows between the buyer types. The multipliers satisfy a conservation law, and the non-uniqueness of the multipliers is connected to the stability of the solution structure. The digraph interpretation can be used in computing the solution and solving the pricing problem under limited information.

5 - Reputation: From Resolution for Truthful Online Auctions to the Model of Optimal One-gambler Problem

Milan Bradonjic, Los Alamos National Laboratory, MS B284, Los Alamos, NM, 87545, United States of America, bradonjic@gmail.com

We study reputation mechanisms, beyond the scope, which game theory usually discusses under the notion of reputation. We first build and derive the resolution of truthful online auction mechanisms. Further, we analyze the optimal one-gambler/one seller problem. We model one-player games, by introducing a new parameter (reputation), which helps us in predicting the agent's behavior, in real-world situations: behavior of a gambler, real-estate dealer, etc.

■ WD56

H-Room 307, Third Floor

Revenue Management

Contributed Session

Chair: Li Zou, Assistant Professor, Embry-Riddle Aeronautical University, 600 S Clyde Morris Blvd, Daytona Beach, FL, 32114, United States of America, zoul@erau.edu

1 - Capturing the Market Responses of the GBB Products to Price Changes

Baofu Ma, Merchandising Research Analyst, AutoZone Inc., 123 S. Front St., Memphis, TN, 38103, United States of America, ma_bfu@yahoo.com, Gurcan Bicken

Auto parts retailers usually provide customers with Good, Better, Best (GBB product choices, which are vehicle specific. Store availability of the GBB products may change over time. In this study, we intent to capture the effect of the price change on overall market response of GBB products in terms of changes in conversion rates. The parameters of a nonlinear statistical model are estimated from the historical data and the predictions of the model are tested for different store groups.

2 - Revenue Management and Capacity Allocation with Limited Information in Global Air Cargo Operations

Ravi Kumar, Distinguished Professor and Dean, KAIST Busness School, Seoul, 130702, Korea, Republic of, Rkumar@marshall.usc.edu, Seungbeom Kim

With limited information on demand, several models to improve the revenues of an air cargo company are developed, with focus on capacity allocation to their global regional sales offices. The results show that their revenue increases significantly even when we use the simplest developed models compared to their current methods.

3 - The Application of Inventory Transshipment Modeling to Air Cargo Revenue Management

Li Zou, Assistant Professor, Embry-Riddle Aeronautical University, 600 S Clyde Morris Blvd, Daytona Beach, FL, 32114, United States of America, zoul@erau.edu, Martin Dresner, Chunyan Yu

We apply transshipment modeling to investigate the air cargo revenue management problem in the cargo co-mingling context. The practice of co-mingling among carriers allows air cargo to be transferred to another plane that is not in the initiating airline's fleet. With an interline co-mingling, the payload capacity can be reallocated. A two-location newsvendor model is used to analyze the role of transshipment price in airline's overbooking decision-making and its profitability implications.

■ WD58

H-Room 309, Third Floor

Parallel Machine Scheduling

Contributed Session

Chair: Nelson Uhan, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, Grissom Hall 262, West Lafayette, IN, 47907, United States of America, nuhan@purdue.edu

1 - Lagrangian Relaxation for Parallel Machine Scheduling with Sequence-dependent Set-up Times

Takashi Irohara, Associate Professor, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554, Japan, irohara@sophia.ac.jp, Naoki Uchida

In this paper, a Lagrangian relaxation based heuristic algorithm is proposed for parallel machine scheduling problem with sequence-dependent setup times. The objective function is to minimize the tardiness and earliness of due dates.

Computational experiments were conducted to show the effectiveness of the proposed algorithm by comparing the results with other literature.

2 - A Random Keys Genetic Algorithm for Batch Scheduling Problem
Shubin Xu, Lundquist College of Business, 1208 University of Oregon, Eugene, OR, 97403, United States of America, sxu@uoregon.edu, James Bean

We study the problem of minimizing total weighted tardiness on parallel non-identical batch processing machines. We formulate the problem as a nonlinear integer programming model and then propose a genetic algorithm based on random keys encoding to find good solutions in reasonable computation time.

3 - Batch Loading on Parallel Machines with Incompatible Job Families and Release Times
Eray Cakici, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, ecakici@uark.edu, Neil Geismar, John Fowler, Scott Mason

We study the problem of minimizing weighted completion times on parallel identical batch processing machines with dynamic job arrivals. Each job is associated with a family, weight (priority), and size. Only jobs of the same family can be batched together in which total size of the jobs does not exceed the batch capacities. We present a mathematical model and heuristic algorithms employing different local search procedures individually and sequentially under variable neighborhood search scheme.

4 - Minimizing The Sum of Weighted Completion Times in a Concurrent Open Shop
Nelson Uhan, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, Grissom Hall 262, West Lafayette, IN, 47907, United States of America, nuhan@purdue.edu, Maurice Queyranne, Monaldo Mastrolilli, Andreas Schulz, Ola Svensson

We study minimizing the sum of weighted completion times in a concurrent open shop. We propose a simple combinatorial 2-approximation algorithm. We also show that this problem is inapproximable within a factor strictly less than 6/5 (or within a factor strictly less than 4/3 if the Unique Games Conjecture is true) unless P = NP. Finally, we show that several natural linear programming relaxations for this problem all have an integrality gap of 2.

■ WD59

H-Room 310, Third Floor

Business Analytics & Other Topics

Contributed Session

Chair: Hsu-Shih Shih, Professor and Director, Grad. Inst. of Management Sciences, Tamknag University, 151 Ying-Chuan Rd, Tamsui, Taipei 25137, Taiwan - ROC, hshih@mail.tku.edu.tw

1 - Task Allocation Based on Social-welfare Function for a Resource-bounded Robot Team
Min-Hyuk Kim, PhD Student, Purdue University, 3409 Cheswick Ct., G5, West Lafayette, IN, 47906, United States of America, kim507@purdue.edu

We address multi-robot task allocation problem for a resource-bounded robot team operating in unknown dynamic environments. Two optimization objectives, minimizing total resource usage as well as maximizing task completion rate are considered. We propose social-welfare based task allocation method incorporating simultaneously resource consumption and resource balancing. Simulation experiments demonstrate the superiority of our approach, achieving the two objectives satisfactorily.

2 - Managing Customer Input Quality in Professional Services
Anil Akpinar, PhD Candidate, Instituto de Empresa, C/ Maria de Molina 12 Bajo, Madrid, 28006, Spain, aakpinar.phd2010@alumno.ie.edu, Fabrizio Salvador

In professional business-to-business services one of the major issues affecting the project performance is the customers' input quality. We investigate whether an engagement model that dynamically allocates resources under customer change requests can be used to provide a robust service delivery process. Furthermore, we also explore the contingency factors which might moderate the relationship between utilization of an engagement model and project performance in terms of cost and time.

3 - A Review of Multi-level Non-linear Programming
Hsu-Shih Shih, Professor and Director, Grad. Inst. of Management Sciences, Tamknag University, 151 Ying-Chuan Rd, Tamsui, Taipei, 25137, Taiwan - ROC, hshih@mail.tku.edu.tw

Simulating the actual decision-making process of the hierarchical structure of an organization, multi-level programming is a practical and useful approach to decentralized planning problems. However, most of the applications are formulated as non-linear programming problems, especially for the "green" area. We will organize the current methods and applications of multi-level non-linear programming in a systematic way as a stepping stone of further investigation.

■ WD60

H-Room 311, Third Floor

Stochastic Optimization III

Contributed Session

Chair: Aiko Kurushima, Assistant Professor, Tokyo University of Science, 1-14-6 Kudan-kita, Chiyoda-ku, Tokyo, 102-0073, Japan, kul@ms.kagu.tus.ac.jp

1 - Endogenous Uncertainty in Natural Gas
Lars Hellemo, PhD Candidate, NTNU, Alfred Getz veg 3, Trondheim, 7491, Norway, lars.hellemo@iot.ntnu.no

An underlying assumption of traditional stochastic programs is that uncertainty is unaffected by decisions (exogenous uncertainty). We propose a taxonomy of stochastic programs with endogenous uncertainty, ranging from stochastic LP to MINLP problems. We provide some examples from the natural gas industry where such models will be useful. We consider cases where random price formation in markets is affected by decisions and information retrieval through development of new fields.

2 - The Option-value of R&D
Rutger-Jan Lange, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, r.lange@jbs.cam.ac.uk, Daniel Ralph

Developing new production technology is risky. Typically production cost falls (on average) exponentially as investment in R&D or capacity rises. While, stochastic learning curves are usually treated in discrete-time and numerically, our continuous-time approach gives an integral equation for the optimal boundary. When production cost is above the (exogenous) market-price, we decide whether to continue investing or abandon the technology. This is similar to valuing an American option in finance.

3 - Bounding the Reliability of a Stochastic Transportation Network with Random Demands & ARC Capacities
Merve Unuvar, Doctoral Student, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, merveunuvar@gmail.com

Bounding the reliability of a transportation network was proposed by Pr kopa and Boros (Op.Res.39, 119-129), where the demand values are random and binomial moment bounds are used. In many practical applications however, the arc capacities are also random. This makes the number of feasibility constraints very large. We propose efficient elimination procedures of the redundant constraints and use up to date bounding technique to approximate the probability of the existence of a feasible flow.

4 - Online Stochastic Optimization in the Large: Application to Kidney Exchange
Tuomas Sandholm, Professor, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sandholm@cs.cmu.edu, Pranjal Awasthi

Current kidney exchanges decide offline who gets kidneys from whom. However, patient-donor pairs and altruistic donors appear and expire over time. We develop trajectory-based online stochastic optimization algorithms (which leverage our scalable optimal offline solver) for this. We identify tradeoffs among the algorithms' parameters. The algorithms outperform prior approaches.

5 - Full-information Shelf-life Problem
Aiko Kurushima, Assistant Professor, Tokyo University of Science, 1-14-6 Kudan-kita, Chiyoda-ku, Tokyo, 102-0073, Japan, kul@ms.kagu.tus.ac.jp, Katsunori Ano

Here we study a generalization of the secretary problem. The objective is to maximize the expected time period of owning the relatively best or second-best object. The problem was solved for no-information case in Szajowski and Tamaki (2006). We deal with the problem in the full-information case, that is, when the decision maker can observe the value of the objects.

■ WD63

H-Room 314, Third Floor

Health Care Strategy III

Contributed Session

Chair: Vasso Koufi, Research Assistant, Department of Digital Systems, University of Piraeus, 80, Karaoli & Dimitriou Str, Piraeus, GR, 18534, Greece, vassok@unipi.gr

1 - Modeling the Adoption of Identification Standards in the Healthcare Supply Chain
Anglelica Burbano, Graduate Research Assistant, University of Arkansas, Bell Engineering Center, Fayetteville, AR, 72703, United States of America, aburbano@uark.edu, Ronald L. Rardin

This research project will investigate the identification standards adoption process within healthcare supply chain and develop a theoretical model based on the diffusion of innovations theory to understand the system behavior. The model will allow the identification of the barriers that are preventing the adoption of identification standards, facilitate understanding the system behavior and allow the design and test of policies (incentives) to move the system forward.

2 - Context-aware Security for Personal Electronic Health Records
Vasso Koufi, Research Assistant, Department of Digital Systems, University of Piraeus, 80, Karaoli & Dimitriou Str, Piraeus, GR, 18534, Greece, vassok@unipi.gr, Flora Malamateniou, George Vassilacopoulos

This presentation deals with security issues arising in electronic health records (EHR) whose architectures are based on the fundamental assumptions that each patient retains authority over access to any portion of his/her record. In particular, the presentation is concerned with context-aware, discretionary authorizations to designated healthcare professionals in some cases so that critical medical information is made available where and when needed without the patient's consent.

■ WD65

H-Room 202B, Second Floor

Multi-Item Inventory Management II

Contributed Session

Chair: Wenting Pan, University of California-Irvine, The Paul Merage School, Irvine, CA, 92697, United States of America, wpan06@merage.uci.edu

1 - Analysis of an Inventory Problem with Substitution when Demand and Yield are Uncertain
Tugce Gizem Martagan, Mississippi State University, Mississippi State University, Starkville, MS, United States of America, tgm63@msstate.edu, Burak Eksioglu

We analyze an inventory problem with two products, random demand, and random supply. The supply chain includes two retailers that sell two substitutable products and two suppliers. Each retailer faces a stochastic demand for the product she sells and replenishes her inventory from her supplier. The supplier provides a random fraction of the quantity requested. A given percentage of customers with unmet demand will substitute the other product. We assume that the two retailers who make ordering decisions are rational players. Game theory is used to find the order quantities.

2 - (s,S) Inventory Systems with Correlated Demands
Jian-Qiang Hu, Professor, Fudan University, Siyuan Building, Rm 508, 670 Guoshun Rd, Shanghai, 200433, China, hujq@fudan.edu.cn, Cheng Zhang, Chenbo Zhu

In most inventory models it is assumed that demands are independent of each other. However, it has been observed that in many applications demands are often correlated. In this work, we study an (s, S) inventory system with Markov modulated demands. Using the technique of MacLaurin series expansion, we derive recursive algorithms to calculate the moments of the inventory level, as well as various performance measures of the system. Numerical results are provided to validate our algorithms.

3 - An Inventory Rationing Model for Multiple Demand Classes with Backordering
Benjamin Neve, PhD Candidate, University of Alabama, 800 Energy Cntr Blvd, Apt 1208, Northport, AL, 35473, United States of America, bneve@cba.ua.edu, Charles Schmidt

We consider a continuous-review inventory system with backordering and stock rationing over several classes of customer demand. Similar to recent literature, we use the framework of a multi-echelon inventory system to describe the physics of the stock-rationing system. However, instead of considering fill rates, as in the previous work, we develop a cost objective. Using a heuristic, we seek an inventory replenishment policy, coupled with a stock rationing policy, to minimize related costs.

4 - Optimal Ordering Decisions for a Two-component Assembly System under Supply Uncertainty
Wenting Pan, University of California-Irvine, The Paul Merage School, Irvine, CA, 92697, United States of America, wpan06@merage.uci.edu, Rick So

We consider a two-component assemble-to-order system where one of the two components faces proportional random yield. We analyze how the supply uncertainty affects the ordering decisions of the components under both deterministic and stochastic demands. We further extend the analysis to price-dependent demands and show how the supply uncertainty affects both the optimal pricing and ordering decisions.

■ WD66

H-Room 204A, Second Floor

Networks and Graphs

Contributed Session

Chair: Feng Pan, Los Alamos National Lab, Risk Analysis & Decision Support Systems, Los Alamos, NM, 87545, United States of America, fpan@lanl.gov

1 - Decomposistion Heuristic Algorithm for Low-connectivity Network Design Problem
Chih-Chi Hu, National Taiwan University of Science and Technology, 43, Sec. 4, Keelung Rd., Taipei, Taiwan - ROC, alexhung.cs@gmail.com, Cheng-Huang Hung

Low-connectivity network design problem (LCND) is the key issue to build an economical communication system. This study decomposes the original problem into two sub-problems according to the connectivity requirements. This study develops a heuristic combining depth-first-search and cycle-shrinking method to solve the first sub-problem, and uses Mehlhorn's algorithm to solve the second. Computational results show this heuristic works better in Euclidean instances than in Non-Euclidean.

2 - Matching-based Alternating Hamiltonian Cyles on Threshold Graphs
Kai Helge Becker, London School of Economics and Political Science, Operational Research Group, Houghton Street, London, WC2A 2AE, United Kingdom, k.h.becker@lse.ac.uk

To a given graph G with an even number of nodes we add the edges of an arbitrary matching M. G is said to be "matching-based alternating Hamiltonian w.r.t. M" if there exists a Hamiltonian cycle such that every consecutive pair of edges contains one edge from G and one edge from M. We analyze the case where G is a threshold graph (TG) and show how, for a given M, matching-based alternating Hamiltonian TGs can be recognized in polynomial time. The problem has an application in the paper industry.

3 - The Bounded Cycle Cover Problem
Irene Loiseau, Professor, Department de Computacian- FCEN-Universidad de Buenos Aires, Pabellan I- Ciudad Universitaria, Buenos Aires, 1428, Argentina, irene@dc.uba.ar, Nelson Maculan, Guillermo Picardi

We will review exact and heuristics algorithms for the Bounded Cycle Cover Problem. BCCP requires to determine a minimum cost cycle cover of a graph, with cycles bounded in length and number of edges. This problem arises in the design of fiber-optic telecommunications networks that employ multiple self-healing rings to provide routing for communication traffic, even in the event of a fiber cut or other kinds of failures. New results of algorithms we developed for the BCCP will be presented.

4 - Interdicting Shortest Paths on Random Geometric Graphs
Feng Pan, Los Alamos National Lab, Risk Analysis & Decision Support Systems, Los Alamos, NM, 87545, United States of America, fpan@lanl.gov, Milan Bradonjic, Aric Hagberg

Vulnerability in sensor networks can be measured by the disruption of shortest paths. Using random geometric graphs as a model for sensor networks we derive probabilities that the shortest paths are interdicted when edges are either optimally or randomly removed. We compare the shortest path difference between the two methods when varying the number of deleted edges and the average node degree.

■ WD67

H-Room 204B, Second Floor

Stochastic Programming and Applications

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Lewis Ntaimo, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

1 - Stochastic Mixed-integer Programming Models for Wildfire Initial Response Planning
Julian Gallego, PhD Student, Texas A&M University, 241 Zachry, TAMU 3131, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Lewis Ntaimo

In this talk, we present two-stage stochastic mixed-integer programming models for wildfire initial response planning under uncertainty. We consider both standard response and explicit fire growth response models. Finally, we discuss solution methods for the models and report on a computational study using instances based an actual data for one of the Texas Forest Service fire planning units in East Texas.

2 - Two-stage Stochastic Integer Programming for Angiogenesis and Vascular Network Design

Siqian (May) Shen, PhD Student, Department of ISE, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sshen@ufl.edu, Cole Smith

Angiogenesis is the growth of new blood vessels from existing vessels, which is of key interest in combating many diseases. We consider a two-stage stochastic optimization problem of vascular network design in tissue engineering. We plant arterial and venous source seeds at the first stage, and then interdigitate vascular trees according to biophysical principles. We employ robust optimization to minimize the total cost subject to a vascular formation that allows tissue metabolic exchange.

■ WD68

H-Room 206, Second Floor

SP in Finance

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: John Birge, Professor, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, john.birge@chicagogsb.edu

1 - Optimal Index Tracking Using Cointegrated Simulated Sample Paths

Elmira Popova, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States of America, elmira@mail.utexas.edu, Ivilina Popova, David Morton, Alexander Galenko

We present a new model for index tracking. The scenarios for the resulting stochastic programming problem are generated from a modified Vector-AutoRegressive-To-Anything (VARTA) model that preserves the cointegrated property of the underlying time series. We test our approach on MSCI Australia, Japan, Hong Kong and Pacific Indexes.

2 - Index Tracking and Enhanced Indexation Using a Parametric Approach

Luis Chavez-Bedoya, Northwestern University, 1915 Maple Ave, Evanston, IL, 60201, United States of America, luischavez2011@u.northwestern.edu

Computational complexity and empirical results of the classic integer programming approach for index tracking and enhanced indexation motivate the use of a parametric model. The weights are modeled as functions of assets characteristics and similarity measures of the assets with the index. This approach permits to handle non-linear and non-convex objectives functions that are common in index tracking and enhanced indexation.

3 - Aribitrage-free Pricing Bounds of Multivariate Nonconvex Contingent Claims Using SP

Chanaka Edirisinghe, Professor, University of Tennessee, College of Business, Knoxville, TN, United States of America, chanaka@utk.edu

This talk covers pricing of contingent claims, such as financial options, using discrete time stochastic programming. When the claims are nonconvex in multivariate underliers that are correlated, and using multinomial scenario trees, we compute the SP solution of the bounds on pricing using recursive formulae. We show that that even when the claim are separable in the underliers, our joint pricing model provides much tighter bounds than those implied by the component claim prices.

■ WD69

H-Indigo A, Second Floor

Issues in Revenue Management

Sponsor: Marketing Science
Sponsored Session

Chair: Pratt Hetrakul, PhD Student, University of Maryland, Department of Civil Engineering, 1173 Glenn L. Martin Hall Bldg #088, College Park, MD, 20742, United States of America, hetrakul@umd.edu

1 - Revenue Management for Ad Sales

Dana Popescu, Assistant Professor, INSEAD, 1 Ayer Rajah Ave., Singapore, 138676, Singapore, dana.popescu@insead.edu, Sridhar Seshadri

We propose a new model of ad sales for the cable media industry. We start with an empirical investigation of the factors that affect the negotiated plan prices. We then formulate a new model for allocating media advertising resources. The new aspect is that each ad spot generates different revenue depending on the target audience of the advertiser to whom it is sold. We propose several heuristics to solve the allocation problem.

2 - Pricing for Cruise Line Revenue Management

Xiaodong Sun, Visiting scholar, Syracuse University, 721 University Avenue, Syracuse, NY, 13244, United States of America, xsun08@syr.edu, Dinesh Gauri, Scott Webster

We present a method for setting and adjusting prices over the selling horizon for a cruise,and evaluate the method using data from a major North American cruise company.We use dynamic pricing having a two-stage price adjustment mechanism in each week to set prices through demand learning.In the first stage,the parameters of demand function are estimated based on past ticket sales.In the second stage,a constrained nonlinear program is solved to determine the optimal prices for remaining weeks.

3 - Dynamic Demand Models for Revenue Management

Pratt Hetrakul, PhD Student, University of Maryland, Department of Civil Engineering, 1173 Glenn L. Martin Hall Bldg #088, College Park, MD, 20742, United States of America, hetrakul@umd.edu, Shahab Toobaie, Cinzia Cirillo

This paper addresses the benefit of incorporating dynamic discrete choice modeling techniques into the revenue management process. It aims at providing policy makers with optimal pricing that accounts for the dynamics in consumers' behavior over time. The method is applied to the Amtrak Acela Express monthly sales data; the customer choices on status transition among no buy, reservation, cancellation or confirmation are modeled within 30 days prior to the train departure date.

■ WD71

H-Indigo C, Second Floor

Remanufacturing in SCM

Contributed Session

Chair: Gonca Yildirim, University of Florida, Department of ISE, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, gonca@ufl.edu

1 - Coordination Structure Decisions in a Closed-loop Supply Chain with Remanufacturing

Hamidreza Faramarzi, Wilfrid Laurier University, 75 University Ave. West, Waterloo, Canada, fara3662@wlu.ca, Ignacio Castillo

We model a closed-loop supply chain (CLSC) that includes a retailer, a manufacturer, and a remanufacturer. We investigate the pricing decisions at the retailer for new and remanufactured products. In addition, we show how CLSC coordination structures compare with each other under different levels of quality of returns and the consumers' perceptions of the remanufactured products. We help the CLSC members with their decisions on who to coordinate with under different circumstances.

2 - Hybrid Manufacturing System in Closed-loop Supply Chain

Yuki Oshita, Graduate Student, Graduate School, Tokyo Metropolitan University, 6-6, Asahigaoka, Hino, Tokyo, 191-0065, Japan, yuuki-oshita@live.jp, Yasutaka Kainuma

In this paper, we proposed an optimal ordering policy of parts in a Closed-Loop Supply Chain. The manufacturer in the supply chain decides the order quantity of new and reused parts minimizing their total cost. The total cost of manufacturer includes ordering cost of parts, holding cost of products and opportunity loss cost. As a case study, we apply our proposal policy to a product of a certain corporation and confirm the efficiency of the proposal.

3 - Forecasting Automotive Core Returns Using Cox-proportional Hazard Rate Models

Akhilesh Kumar, Doctoral Candidate, Department of Industrial & Manufacturing Engineering, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, a.kumar@wayne.edu, Ratna Babu Chinnam

In the automotive industry, forecasting Independent-After Market (IAM) core returns for remanufacturing is challenging. This is often attributable to significant demand uncertainties and data sparsity (large number of products, customers, and warehouses but with low volumes). We propose Cox-Proportional Hazard Rate Models to overcome these challenges. Preliminary results are promising.

4 - Disassembly and Recovery Planning for a Salvaging Facility

Gonca Yildirim, University of Florida, Department of ISE, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, gonca@ufl.edu, Elif Akcali, Z. Pelin Bayindir

Stochastic inventory models are investigated for a salvaging facility that disassembles a type of end-of-life product for recovery. A single-period newsvendor type of setting is considered to capture the basic tradeoffs between unit cost and revenue structures under three different product structure and recovery operation schemes. A numerical study is conducted to analyze the effects of dependencies due to product and recovery operation structures.

■ WD73

H-Indigo E, Second Floor

Optimal Control of Queues II

Contributed Session

Chair: Seok Ho Chang, Assistant Professor, Nanyang Technological University, School of Mechanical & Aerospace Enginee, Singapore, Singapore, seokhochang@gmail.com

1 - Optimization of Video Streaming over Networks Using Queueing Models for Content-aware Networking

Liang Chen, Unversity of Maryland, 9216 Limestone Place, College Park, MD, 20740, United States of America, liangchen.member@gmail.com

We aim to optimize video streaming over networks using queueing models for content-aware networking. We propose two models to achieve content-aware networking for various types of video frames. One is based on parallel processing and bandwidth allocation, and the other is based on priority queueing. The second model is generally more effective than the first one, but has more complex structures. Moreover, we also formulate problems to accommodate the QoS requirements of voice and data traffic.

2 - Dynamic Assignment of Cross-trained Agents to Multiple Classes of Impatient Customers: An N Network

Hoda Parvin, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, hoda@umich.edu, Hyun-soo Ahn, Mark Van Oyen

In this research we study the dynamic assignment of cross-trained agents to multiple classes of impatient customers. We consider a finite capacity queueing system with a penalty associated with rejecting arriving customers, a queue length dependent customer reneging rate, linear holding costs and lump-sum reneging penalties. We model this problem as a continuous-time Markov decision processes and investigate the structure of the optimal assignment policy.

3 - Capacity Allocation Between Make-to-stock and Make-to-order Operations

Ilhyung Kim, Associate Professor, Western Washington University, 516 High Street, Bellingham, WA, 98225-9077, United States of America, ilhyunk@wwu.edu, George Zhang, Gangshu Cai, Yugang Yu

We investigate a hybrid manufacturing system which combines "make-to-order" and "make-to-stock" operations by utilizing a multi-server queueing model with server vacations. With such a model, the issue of capacity allocation and inventory control is addressed. Using approximations and bounds, we develop some closed form solutions to the optimal policy parameters. Simulation results are presented to show the accuracy of our approximation scheme.

4 - Analysis of Two Unreliable Batch Machines with a Finite Buffer in Between and Threshold Policies

Seok Ho Chang, Assistant Professor, Nanyang Technological University, School of Mechanical & Aerospace Enginee, Singapore, Singapore, seokhochang@gmail.com, Stanley B. Gershwin

This paper considers two unreliable batch machines with a finite buffer in between and threshold policies. The purpose of this paper is to obtain insight into the influence of threshold policies on the performance of the system. Numerical examples and interpretation are presented.

■ WD74

H-Indigo H, Second Floor

Markov Decision Processes/Optimal Control

Contributed Session

Chair: Oleksandr Shlakhter, University of Toronto, 171 Erskine Ave., # PH 1, Toronto, ON, M4P 1Y8, Canada, shlakht@mie.utoronto.ca

1 - Sampled Fictitious Play Based Learning Algorithms for Discounted Markov Decision Processes

Esra Sisikoglu, PhD Candidate, University of Michigan, Industrial and Operations Engineering, Ann Arbor, MI, United States of America, esisikog@umich.edu, Marina Epelman, Robert Smith

We develop an algorithm using Sampled Fictitious Play (SFP) concepts for solving a discounted homogeneous Markov Decision Process (MDP) where the transition probabilities are unknown. In the algorithm, we estimate and update the unknown transition probabilities, the optimal value and the optimal action of each state, simultaneously. We show the convergence of the algorithm and present convergence rate results. We compare the performance of our algorithm with SARSA (a variant of Q-Learning).

2 - Defending Substitutable IT Assets: A Duopolistic Model for Optimal IT Security Investment

Tridib Bandyopadhyay, Assistant Professor (IS), Kennesaw State University, 1000 Chastain Road, Kennesaw, GA, 30144, United States of America, tbandyop@kennesaw.edu, DengPan Liu, Vijay Mookerjee

Hackers scope potential targets before attempting to access/steal a given type of information asset, which routinely ends with a short list of firms, from which the hacker picks up the softest target. Utilizing an optimal control framework, we analyze the infinite horizon IT security investment decisions of firms who find them in such a substitutable short list of hacking targets.

3 - Efficient Computational Approaches to Markov Decision Processes

Oleksandr Shlakhter, University of Toronto, 171 Erskine Ave., # PH 1, Toronto, ON, M4P 1Y8, Canada, shlakht@mie.utoronto.ca, Chi Guhn Lee

We propose a new approach to accelerating the convergence of the modified policy iteration methods for Markov decision processes with the total expected discounted and average rewards. In the new policy iteration method an additional operator is applied to the iterate generated by Markov operators, resulting in a bigger improvement in each iteration. We characterize a class of operators that can be used in combination with contraction mapping operators and propose two such operators.

Wednesday, 4:30pm - 6:00pm

■ WE02

C-Room 22, Upper Level

Decision Analysis II

Contributed Session

Chair: Scott O'Leary-Kelly, Associate Professor, University of Arkansas, WCOB 204, University of Arkansas, Fayetteville, AR, 72701, United States of America, solearykelly@walton.uark.edu

1 - Assessing the Impact of Business Intelligence Systems on Decision Speed and Decision Quality

Criston Cox, Major, United States Marine Corps, First Marine Expeditionary Force, Camp Pendleton, CA, 92055, United States of America, criston.cox@usmc.mil, Yajiong Xue, Yufeng Tu

Previous literature has shown a positive relationship between decision speed and firm performance in high velocity environments. This research further contributes by assessing whether the use of BI systems provides a balanced level of information availability, information quality and information quantity, and in turn provides faster decision speed and better decision quality. Structural Equation Modeling is employed for hypotheses testing.

2 - Optimum Location of a Light Source with Linear Program

MD Noor E Alam, University of Alberta, Edmondton, Edmonton, AB, Canada, nooruoa@yahoo.ca

This paper will use a fictitious problem of placing light source in a park to minimize the amount of darkness. For the non linearity in supply function arises from the basic principle of light physics, and to simultaneously minimizing both the extra supply and unfulfilled demand, the optimization problem become a non linear model. The equivalent linear programming model is implemented in an AMPL environment and solves it with the CPLEX solver to find the optimum location of the light post.

3 - Golf Course Revenue Management

Lila Rasekh, Sr. Operations Research Analyst, Disney, 13001 Mulberry Park Dr. #131, Orlando, FL, 32821, United States of America, lila.rasekh@disney.com

This research is based on an analysis of golf course tee-time reservation practice. Specifically, this paper presents a unique linear model that can be used to assign the demand to the available tee-times, and thus, maximize their utilization and the total revenue. The model is solved by using the SAS-OR build-in branch and bound (B&B) algorithm. To reduce the computational time, we propose a heuristic to find an initial feasible solution to the model.

4 - Ranking and Selecting Alternatives: Combining Expert Forecasts for Decision Making

Scott O'Leary-Kelly, Associate Professor, University of Arkansas, WCOB 204, University of Arkansas, Fayetteville, AR, 72701, United States of America, solearykelly@walton.uark.edu, John Aloysius, Christopher Conway

Numerous decisions under uncertainty involve the ranking and selection of alternatives from a choice set. A consensus of expert opinions has been shown to be an effective method of forecasting for other types of decisions. We report the results of a study showing that a consensus of expert opinions outperformed the forecast accuracy of individual decision makers, which in turn outperformed the individual expert opinions.

■ WE03

C-Room 23A, Upper Level

Game Theory Applications

Contributed Session

Chair: Katerina Papadaki, Department of Management, Operational Research Group, London School of Economics, London, WC2A 2AE, United Kingdom, k.p.papadaki@lse.ac.uk

1 - A Game-theoretic Framework for Public Private Partnership in Transportation Infrastructure

Ali Z. Rezvani, Graduate Assistant, Rutgers The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, rezvani@eden.rutgers.edu, Mohsen Jafari, Farnaz Farzan

Participation of private entities in built and operation of transpiration infrastructure through various Public Private Partnership models creates new interactions between different elements involved in transportation infrastructure management. This research introduces a new analytical framework for modeling these new interactions to understand and optimize effects of decisions made by the public authority in charge of the network on different elements in transpiration infrastructure network.

2 - Game Theoretic Analysis of the Food Versus Fuel Supply Chain

Adaora Okwo, Student, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States of America, aokwo@gatech.edu

Integration of the agricultural and energy sectors through biofuel development may have serious implications for the pricing and supply of food, particularly in developing regions. This work employs a non-cooperative game theoretic supply chain model to evaluate the potential impacts of various biofuel policies on the allocation of land between food and energy feedstocks. The model describes farmer allocation responses under various price, incentive (subsidies) and mandate (biofuel) scenarios.

3 - Suppliers Competition under Default Threat

Mike Mingcheng Wei, Washington University at St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130, United States of America, weim@olin.wustl.edu, Bin Jiang, Tao Yao

In emerging market, due to the financial infeasibility, suppliers under the threat of default have different objectives from normal profit-seeking companies. This paper analytically tests how profit-seeking or survival-seeking behaviors on various settings, such as single period versus multiple periods and fixed demand versus random demand, affect the suppliers' final decisions.

4 - Shortest Path Tree Games In Wireless Multi-hop Networks (WMNs)

Katerina Papadaki, Department of Management, Operational Research Group, London School of Economics, London, WC2A 2AE, United Kingdom, k.p.papadaki@lse.ac.uk, Nayat Horozoglu

In WMNs a root node provides connectivity to geographically separated users, where users can relay information for other users. If all users cooperate, they can use their shortest path tree to route the information. The users need to find a mutually satisfactory cost allocation of the shortest path tree cost. We formulate the problem as a cooperative game, derive structural and dominance properties and use them to reduce the complexity of finding the nucleolus, a well known fair cost allocation.

■ WE05

C-Room 23C, Upper Level

Quality Management I

Contributed Session

Chair: Venkateswarlu Pulakanam, Senior Lecturer, University of Canterbury, Department of Management, Private Bag 4800, Christchurch, 8140, New Zealand, venkat.pulakanam@canterbury.ac.nz

1 - The Impact of ISO 14000 on Corporate Management: A Survey

Ahmad Karim, Professor, Indiana Purdue University, School of Business, Ft.Wayne, IN, 46805, United States of America, karim@ipfw.edu, Amer Karim

The ISO 14000 series of environmental standards have been designed in environmentally responsible manufacturing (ERM). Like its predecessor, the ISO 9000 standards, it applies the same approaches to environmental standards and processes. A survey utilizing 1000 respondents was conducted to examine the impact of these standards on both corporate performance and corporate environmental system (EMS).

2 - The Contribution of Quality Management Practices to Innovation

Dong-young Kim, Carleton University, 21 Rockfield Crescent, Ottawa, K2E5L6, Canada, eakims@gmail.com, Uma Kumar, Vinod Kumar

The purpose of this study is to (1) develop a theoretical framework comprising eight quality management (QM) practices and five types of innovation and (2) suggest testable propositions about the interaction effects among QM practices.

3 - Is Six Sigma Appropriate For SMEs?

Venkateswarlu Pulakanam, Senior Lecturer, University of Canterbury, Department of Management, Private Bag 4800, Christchurch, 8140, New Zealand, venkat.pulakanam@canterbury.ac.nz, Nigel Grigg

In this paper and presentation, the authors will examine and present international documentary evidence in relation to: (1) the effectiveness of Six Sigma as an approach internationally; and (2) the historical levels of success of other, similar quality improvement methodologies in the context of small- and medium-sized enterprises (SMEs; and;(3) The feasibility and the cost benefits of implementing Six Sigma in SMEs. The research and findings are applicable across all industry sectors.

■ WE06

C-Room 24A, Upper Level

New Implementations of System Reliability Design & Optimization

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jose Ramirez-Marquez, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, United States of America, Jose.Ramirez-Marquez@stevens.edu

1 - Level of Repair Analysis Modeling Using Genetic Algorithms

Jose Espiritu, Assistant Professor, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79968-0521, United States of America, jfespiritu@utep.edu, Oswaldo Aguirre, Carlos Ituarte-Villarreal, Noel Chavez, Heidi Taboada

A Level of Repair Analysis model, determines the most cost-effective maintenance/replacement policy for each component within a system. In the present research, a new genetic algorithm will be developed to capture the repair/replacement decisions as well as the specific location of maintenance actions for the system components. The model takes into account the repair candidates, unit cost, repair labor rate, production lead time, and reliability/maintainability predictions and/or allocations.

2 - Design of Networks Considering Vulnerability: A Multi-objective Approach

Claudio Rocco, Professor, Universidad Central De Venezuela, Apartado Postal 47937, Los Chaguaramos, Caracas, 1041A, Venezuela, croccoucv@gmail.com, Ivan Hernandez, Belzyt Gonzalez

Several network measures, such as characteristic path length or the network efficiency have been used to assess the vulnerability of existing networks. In this paper an approach for the design of new networks is proposed. The approach recognizes that several goals must be satisfied, for example a design with minimum cost and minimum vulnerability. So an approximation of the Pareto Frontier is defined, by using multi-objective evolutionary techniques. Numerical examples illustrate the approach.

3 - A New Holistic Method for Complex Network Reliability Approximation & Critical Components Detection

Chi Zhang, Stevens Institute Of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, chi_zhang@live.com, Jose Ramirez-Marquez

Reliability of complex networks is too complex to be analyzed via traditional techniques. A new algorithm (R-Dijkstra) was first proposed to compute the lower bound of two-terminal binary complex network reliability. The problem to detect the critical components of complex networks was then modeled as a multi-objective DNIP and solved by combining R-Dijkstra with MO-PSDA. This new holistic method makes it possible to estimate the reliability of a complex network and find its critical components.

4 - Analytical Models to Support Design Considerations of a System and its Enabling Sustainment Network

David Nowicki, Associate Professor, Stevens Institute of Technology, Castle Point on the Hudson, Babbio Bldg, 5th Floor, Hoboken, NJ, 07030, United States of America, dnowicki@stevens.edu, Jose Emmanuel Ramirez-Marquez, Wesley Randall

This research focuses on developing decision support models to capture the economic impact of failures across the entire System of System architecture (i.e. a decision-making process that simultaneously considers both Primary System

and its Enabling Support Network) and across a multi-year horizon, with the ultimate goal of improving the effectiveness and efficacy of reliability investment decisions to provide and to extend the SoS capabilities.

■ WE07

C-Room 24B, Upper Level

Panel Discussion: Strategic Research Directions in Quality, Statistics, and Reliability

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706-1572, United States of America, szhou@engr.wisc.edu

1 - Strategic Research Directions in Quality, Statistics, and Reliability
Moderator: Shiyu Zhou, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706-1572, United States of America, szhou@engr.wisc.edu

Due to the fast development of information technology, a vast amount data are now collected and readily available in practices. The availability of data will stimulate the research and development of new methodologies in quality, statistics, and reliability areas. A panel of discussants will present their views and perspectives on the research opportunities that QSR may be able to grasp for the near future. Audiences will be actively involved in the discussion in this session.

■ WE09

C-Room 25A, Upper Level

Applied Probability

Contributed Session

Chair: Raja Jayaraman, Post Doctoral Fellow, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu

1 - Optimal Stopping Problems with Offers From One of Two Possible Distributions
Yen-Ming Lee, University of Southern California, 3715 McClintock Ave, GER 240, Department of Industrial & Systems Engineerin, Los Angeles, 90089-0193, United States of America, yenmingl@usc.edu, Sheldon M. Ross

We study some optimal stopping problems for selling an asset when we are allowed and not allowed to recall past offers. Assume the distribution of offers is fixed and could be one of two possible distributions. The initial probabilities as to which is the true distribution are given and updated in a Bayesian manner as the successive offers are observed. Dynamic programming models and some heuristic policies are presented.

2 - The Nondegenerate Slowdown Diffusion Regime
Rami Atar, Technion, Department of Electrical Engineering, 32000 Haifa, 32000, Israel, atar@ee.technion.ac.il

The nondegenerate slowdown (NDS) regime is a midpoint between the conventional and the Halfin-Whitt diffusion regimes, enjoying the property that delay and service time are of the same order of magnitude. It is distinct from the other regimes in that it gives rise to new limit processes. In the talk we will describe limit results and discuss control formulations under the NDS framework.

3 - Pricing Two-dimensional Product Warranties
Raja Jayaraman, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rajnmsu@yahoo.com, Timothy Matis

Product warranties play a decisive role in purchasing, marketability and customer satisfaction. Manufacturers are often forced to price the product and related warranty costs based on competitive forces in market place, in this presentation we shall focus some of the pricing implications, warranty metrics for products sold under two-dimensional warranties and its implications.

■ WE10

C-Room 25B, Upper Level

Metaheuristics II

Contributed Session

Chair: Heidi Taboada, Assistant Professor, Department of Industrial Engineering, The University of Texas at El Paso, 500 West University Avenue El Paso, El Paso, TX, 79968-0521, United States of America, hataboada@utep.edu

1 - Optimizing Information Survivability, Security, and Cost Using a New Evolutionary Algorithm
Oswaldo Aguirre, Research Assistant, The University of Texas at El Paso, 500 W. University Av., El Paso, TX, 79968-0521, United States of America, faguirre@miners.utep.edu, Heidi Taboada, Claudia Valles

A new multiple objective evolutionary algorithm is presented to solve a data information problem. The data information problem presents three objectives to be optimized: probability of data destruction (survivability), probability of information theft (security), and the total cost. The proposed algorithm optimizes all the objectives simultaneously obtaining a Pareto set of solutions.

2 - A New Heuristic Solution Approach for the Bi-level Problem
Nikolaos Leonardos, Rutgers University, 100 Brett Road, Piscataway, NJ, 08854, United States of America, nikolaos.leonardos@gmail.com, Georgios K.D. Saharidis, Mihalis Golias

Hierarchical optimization deals with mathematical programming problems whose feasible set is implicitly determined by a sequence of nested optimization problems. Herein we present a Genetic Algorithms (GAs) based heuristic for the solution of the bi-level hierarchical optimization based on a multi-objective reformulation of the problem and a Pareto Pruning based selection procedure.

3 - Symmetry Breaking in Genetic Algorithms
Mirko Ruokokoski, Researcher, Systems Analysis Laboratory, Helsinki University of Technology, P.O.Box 1100, Espoo, 02015, Finland, mirko.ruokokoski@tkk.fi, Harri Ehtamo

We introduce a novel genetic algorithm for combinatorial problems containing a great deal of symmetry. The algorithm is based on restricting the search space to subspace consisting of only non-isomorphic solutions with respect to the symmetry. We apply the algorithm to the capacitated vehicle routing problem. Experiments are performed on some standard benchmark problems from the literature.

4 - Transmission and Distribution Systems Optimization Using a New Multiple Objective Evolutionary Algorithms
Heidi Taboada, Assistant Professor, Department of Industrial Engineering, The University of Texas at El Paso, 500 West University Avenue El Paso, El Paso, TX, 79968-0521, United States of America, hataboada@utep.edu, Karla Gutierrez, Jose Espiritu, Noel Chavez

A new multiple objective evolutionary algorithm to solve optimization problems in the electricity transmission and distribution systems is presented. The evolutionary algorithm is applied to the dual element spot network configuration to find the optimal allocation of components. The objectives considered in the model are the minimization of the expected system downtime, the minimization of the system repair time, the minimization of the system cost, and minimization of the system weight.

■ WE18

C-Room 28C, Upper Level

Optimization in Practice IX - Education

Sponsor: Computing Society
Sponsored Session

Chair: Owen Hall, Jr.Professor, Pepperdine University, 24255 Pacific Coast Hwy., Malibu, CA, 90263, United States of America, ohall@pepperdine.edu

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - The UW-Stevens Point Center for Athletic Scheduling
Andy Felt, Associate Professor, University of Wisconsin - Stevens Point, Department of Mathematical Sciences, UWSP, Stevens Point, WI, 54481, United States of America, afelt@uwsp.edu, Eric Pahl

The Center for Athletic Scheduling (CAS) at UWSP is a non-profit organization run by undergraduate math majors. The CAS provides athletic schedules that optimally meet specified constraints NCAA Division III conferences across the country. We use AMPL with CBC to solve the MILP models. We discuss the business model, the origins (references to Trick and Birge, OR/MS Today) of the idea, and some of the challenges we face.

2 - Application of Optimization Techniques in Graduate Management Education

Owen Hall, Jr., Professor, Pepperdine University, 24255 Pacific Coast Hwy., Malibu, CA, 90263, United States of America, ohall@pepperdine.edu

Today the general direction in many MBA programs is towards reducing the emphasis on quantitative-type courses in favor of more general leadership themes as well as specialized electives. The purpose of this presentation is to illustrate how optimization methods including scheduling techniques can be effectively integrated into a program of graduate management education using a blended learning strategy.

3 - Preference-based Assignment of University Students to Parallel Offered Groups

Henrik Heitmann, University of Hamburg, Inst. Operations Research, Von-Melle-Park 5, Hamburg, 20146, Germany, henrik_heitmann@yahoo.de, Wolfgang Brueggemann

In a university-course timetabling problem, there may be many parallel sections of the same class which do not necessarily need to be scheduled simultaneously. Then each student must be assigned to one of these groups. Students' preferences can be used as the objective of the resulting optimization problem with the additional constraints that time clashes have to be avoided on an individual basis. The structure of possible preferences is explored and results for test instances are discussed.

4 - Using SAS to Assign Students to Schools in the Wake County Public School System

Ed Hughes, Product Manager, SAS/OR, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27513, United States of America, Ed.Hughes@sas.com, Rob Pratt, Ivan Oliveira

The Wake County (N.C.) Public School System, 18th largest in the U.S., bases student assignments on multiyear student population forecasts. Goals include reducing: demographic imbalances, overcrowding, travel time, and year-to-year reassignments. Numerous constraints apply. The existing manual process was cumbersome and made evaluating different policies slow and difficult. Using SAS, we developed a grid-enabled optimization approach to generate and visualize multiple solutions for evaluation.

■ WE19

C-Room 28D, Upper Level

Hazmat Transportation

Contributed Session

Chair: Chi Xie, Research Fellow, The University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78759, United States of America, chi.xie@mail.utexas.edu

1 - Managing Rail Hazardous Materials Transportation Risk: The Trade-off Between Track Quality and Speed

Athaphon Kawprasert, Graduate Research Assistant, University of Illinois at Urbana-Champaign, 205 N. Mathews Ave., NCEL, B-118, MC-250, Urbana, IL, 61801, United States of America, akawpra2@illinois.edu, Christopher P.L Barkan

We considered the combined effects of rail infrastructure quality and train speed on hazmat transportation risk. An optimization model is used to determine locations for track improvement that provide the greatest safety benefit given resource constraints. The analysis factors in the effects of route-specific accident rate, release probability, speed, and population density. We describe a case study that considers options for track upgrade that minimize route risk under different policies.

2 - A Strategic Planning Framework to Enhance Infrastructure Network Survivability and Functionality under Disasters

Lili Du, Research Associate, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, IN, 47906, United States of America, ldu@purdue.edu, F. Sibel Salman, Srinivas Peeta

This paper develops a bi-level stochastic program to address the resource allocation problem in disaster management. We aim to enhance the survivability and the functionality of infrastructure networks under risk factors caused by all possible disasters. A heuristic algorithm is developed to iteratively solve the models with "good" feasible solutions.

3 - Parametric Method for Multiobjective Optimal Path Problems with Application to Hazmat Transportation

Chi Xie, Research Fellow, The University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78759, United States of America, chi.xie@mail.utexas.edu, Travis Waller

We develop an approximate parametric algorithm for multiobjective optimal path problems, in which the core procedure is doubly-constrained, parameterized single-objective algorithm that can find either an extreme or nonextreme efficient solution. The algorithm can be flexibly used in different objective preference frameworks with either a priori, a posteriori, or interactive preference setting and is capable of prioritizing solution points that characterize the efficient solution profile.

■ WE20

C-Room 28E, Upper Level

Intelligent Systems in Transportation

Contributed Session

Chair: Melanie Bloos, University of Bremen, Chair of Logistics, Wilhelm-Herbst-Str.5, Bremen, 28359, Germany, bloos@uni-bremen.de

1 - The Integrated System to Estimate Freeway Incident Duration and the Resulting Delay and Queue Length

Woon Kim, Research Assistant, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, wkim2@umd.edu, Gang-Len Chang, Sung Yoon Park

This paper presents an integrated system to estimate incident duration and the consequent delay and queue length in Maryland. The system adopted the Rule-Based Tree method and Multiple Regression as primary models for estimating incident duration and the following delay and queue length, respectively. The overall confidence for the estimated model was over 80% with several remarkable findings regarding the associations between the identified factors and incident duration, delay and queue.

2 - Optimized Map Matching Using Sparse GPS Data From Ambulances

Andrew Mason, University of Auckland, Dept of Eng Sci, Private Bag 92019, Auckland, New Zealand, a.mason@auckland.ac.nz, Shane Henderson

We outline a new dynamic programming approach for determining the most likely route taken by a vehicle given a set of GPS locations & times recorded by a GPS-based system. By using optimisation approaches, this map matching algorithm can solve a complex maximum a-posterior probability problem that takes into account data such as the vehicle's location, heading, and speed. The optimisation approach determines likely routes even when the GPS data points are widely spaced in time or distance.

3 - An Analysis for Shipping Route of Container Carrier Using Vessel Movements Data

Shigeki Toriumi, Chuo University, 1-13-27,Kasuga,Bunkyo-ku, Tokyo, 112-8551, Japan, toriumi@ise.chuo-u.ac.jp

In this paper, we construct a digital shipping route network of ships based on a shipping route chart. And, we estimate the shipping route of each ship by distributing the vessel movements data on the network. If we can clarify the traffic of each shipping route, we can estimate the distribution of the greenhouse gas exhausted by ships. Moreover, when ships navigate the Arctic Ocean, we evaluate the influence.

4 - Priority Rules for the Exchange of Transport Requests in Operative Planning of Cooperating Haulers

Melanie Bloos, University of Bremen, Chair of Logistics, Wilhelm-Herbst-Str.5, Bremen, 28359, Germany, bloos@uni-bremen.de, Jörn Schönberger, Herbert Kopfer

Cooperating haulers in the transport sector can exchange some of their transport requests in order to improve their operational planning. This exchange is referred to as collaborative planning. We define and apply priority rules for the request exchange that can approximately solve the collaborative planning problem. Each hauler therefore faces a pick up and delivery problem. The priority rules can be used in a setting with decentralized decision making.

■ WE29

H-Room 501, Fifth Floor

Product Design for Sustainability

Contributed Session

Chair: Elaine Croft McKenzie, PhD Candidate, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, elaine.croft@gmail.com

1 - Energy Infrastructure for Alternative Fuel Vehicles

Muhammad Dayhim, PhD student, Rutgers University, Department of Industrial & Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, dayhim@rci.rutgers.edu, Mohsen Jafari, Niloufar Sadat Mirhosseini

Alternative fuel vehicle technology and supporting energy infrastructure will become important as we move towards oil independence and environmentally sustainable economy as a whole. In this study we formulate requirements for the future energy infrastructure which will support our nation's Transportation sector. Environmental sustainability, economic efficiency and safety are important factors that we are planning to investigate in designing and operating of this infrastructure.

2 - A Safety Stock Problem in Battery Switch Stations for Electric Vehicles

Yudai Honma, Assistant Professor, Tokyo Metropolitan University, 6-6 Asahigaoka, Hino, 1910065, Japan, yudai@sd.tmu.ac.jp

Electric vehicles (EV) have attracted attention for the clean-energy society for decades. However, as defects of EV, short battery life and limited range are pointed out. To overcome these problems, Project Better Place has proposed a business model of battery switch stations where batteries of EVs can be exchanged. In this study, we formulate a safety stock problem in Battery switch stations and present the features of their business model.

3 - A Framework for Efficient Design of Environmentally-friendly Products and Services

Elaine Croft McKenzie, PhD Candidate, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, elaine.croft@gmail.com, Pablo Durango-Cohen

Sustainable design practices require understanding the relationships and tradeoffs between economic and environmental considerations. Building on work in environmental life-cycle assessment and production economics, we propose an input-output linear programming model for efficient design of goods and services. To illustrate the framework we consider the design and implications of an advertising strategy in a major metropolitan area.

■ WE30

H-Room 502, Fifth Floor

Pricing in Energy Markets

Contributed Session

Chair: Ingrida Radziukyniene, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, ingridar@ufl.edu

1 - Capacity Pricing in Electric Generation Expansion

Mehrdad Pirnia, Student, UWaterloo, #1205, 125 Lincoln Rd, Waterloo, On, N2J2N9, Canada, mpirnia@uwaterloo.ca, David Fuller

We explore a mechanism to give incentive to invest in deregulated electricity markets, involving a long term planning model, maximizing the social welfare by choosing new generation capacities which, along with still existing capacities, can meet demand. It includes binary variables for the building of large new facilities, i.e. it becomes a mixed integer linear/nonlinear program and capacity payments are associated with the binary variables. Finally, the result will be compared with IPSP.

2 - Short-term Price Forecasting in Restructured Energy Markets

Josh Grasso, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, Fl, 32611, United States of America, joshgrasso@gmail.com, Panos Pardalos, Ingrida Radziukyniene

The goal of the research is to perform a comprehensive survey of currently used approaches to short-term electricity price forecasting including time series modeling, expert knowledge based models, and ANN. We will outline implementation strategies, advantages, and disadvantages of these methods. Recommendations will be made on how these methods can be used more effectively and possible improvements that would increase the precision and accuracy of the forecast.

3 - Electricity Financial Instruments

Ingrida Radziukyniene, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, ingridar@ufl.edu, Panos Pardalos

The restructuring of electricity markets has led to competitive electricity price. Most markets experience high volatilities and price spikes, resulting in demand for derivative products to mitigate the market risk. The focus of this research are different types of electricity derivatives, their incorporation into electricity trading and their role in development of hedging strategies. In addition, the influence of financial instruments on various market players is revealed.

■ WE32

H-Room 504, Fifth Level

Portfolio Analysis II

Contributed Session

Chair: Jorge A. Sefair, Departamento de Ingeniera Industrial, Universidad de los Andes, Carrera 1 Este # 19 A-40, Bogota, Colombia, j-sefair@uniandes.edu.co

1 - Heavy Traffic Approach to Insurance Portfolio Modeling

Kwai Hung Henry Lam, PhD Candidate, Harvard University, 434 West 120th Street, Apt 3F, New York, NY, 10027, United States of America, khlam@fas.harvard.edu, Jose Blanchet

In an insurance company, actuarial reserve is held for expected future net cash outflow due to contingent benefit payments to policy holders. This important risk-management quantity is traditionally calculated using equivalence principle, which is an average cash flow calculation. I will introduce a heavy traffic approach to model reserve as stochastic processes under different market conditions. The method captures its time-dependent fluctuation and aims to improve risk management decisions.

2 - Estimation of the Mean-variance Optimal Portfolio Weights by Shrinkage Technique

Takuya Kinkawa, KEIO University, 3-14-1 Hiyoshi, Kouhoku-ku, Yokohama, Kanagawa, 223-8522, Japan, taku@bluesky.memail.jp, Nobuo Shinozaki

To obtain the mean-variance optimal portfolio weights, some previous studies in finance have proposed applying shrinkage estimators. However, only a few studies have addressed this problem analytically. In this study, the dominance of a broader class of Stein type estimators is shown analytically. The obtained results enable us to clarify the conditions for some previously proposed estimators in finance to have smaller risks than the classical estimator.

3 - Equipment Replacement Analysis with an Uncertain Finite Horizon

Chin Hon Tan, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, chinhon@ufl.edu, Joseph Hartman

Equipment replacement strategies are highly dependent on the horizon of analysis. This paper examines the case where the horizon is finite but uncertain. We present a stochastic dynamic programming formulation and explore solutions which minimize expected costs and maximum regret. We also show how the solution can be further improved by designing a lease option contract that is attractive to both the leasee and lessor. Contracts with variable lease rates and constant lease rates are explored.

4 - Linear Approximation for Portfolio Semivariance

Jorge A. Sefair, Departamento de Ingeniera Industrial, Universidad de los Andes, Carrera 1 Este # 19 A-40, Bogota, Colombia, j-sefair@uniandes.edu.co, Andrès L. Medaglia, Carlos Y. Mendez

We propose a new linear approximation for portfolio semivariance with no probability distributional assumptions, offering an excellent adjustment to true semivariance of positively correlated profits. A binary programming model with the embedded approximation generates an efficient frontier that truthfully reveals the existing tradeoff between profit and true semivariance.

■ WE37

H-Sapphire C, Fourth Floor

MSOM/Supply Chain Management

Sponsor: MSOM/ Supply Chain

Sponsored Session

Chair: Hyo duk Shin, Jacobs Scholar, Northwestern University, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, hyoduk-shin@kellogg.northwestern.edu

1 - Incentives for Cost Reduction When Consumers are Strategic

Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, swinney_robert@gsb.stanford.edu, Sang-Hyun Kim

We investigate a firm's incentives for cost reduction efforts when consumers are forward-looking and anticipate that a future cost reduction by the firm may result in a price reduction for end consumers. We further analyze the implications of such behavior on supply chain design and coordination.

2 - Capacity Allocation over a Long Horizon: The Return on Turn-and-Earn

Lauren Xiaoyuan Lu, Assistant Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, Lauren_Lu@unc.edu, Martin Lariviere

We construct a dynamic stochastic game of order competition over an infinite horizon to study a commonly used capacity allocation scheme in the automobile industry: turn-and-earn. We numerically solve for the Markov perfect equilibria using a best reply iteration algorithm. Our results show that the return on a larger allocation depends on capacity tightness and demand volatility. Sales leadership may not be persistent and can be eliminated by the occurrence of extremely low demand.

3 - Supply Contracting under Asymmetric Information and Different Compliance Regimes

Fuqiang Zhang, Assistant Professor, Washington University in St. Louis, FZhang22@WUSTL.EDU, Ehsan Bolandifar, Tianjun Feng

This paper studies a procurement problem of a buyer who sources an input from a supplier with private cost information. We derive optimal menu of contracts under forced and voluntary compliance schemes and propose some simple contracts that can perform well relative to the optimal mechanism.

4 - Optimal Release Time for Sequential Product Introduction
Hyo duk Shin, Jacobs Scholar, Northwestern University, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, hyoduk-shin@kellogg.northwestern.edu, Terrence August

We study sequential product introduction in the context of the motion picture industry. Specifically, we characterize the optimal time window between theatrical and DVD release by modeling how release time impacts consumption under strategic consumer waiting and the potential for repeat purchases (DVD sales).

■ WE39

H-Sapphire E, Fourth Floor

Applications of Cooperative Game Theory in Supply Chain Analysis

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Danko Turcic, Assistant Professor of Operations and Manufacturing Management, Washington University in St. Louis, Olin Business School, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu

1 - Stable Supplier Coalitions in Assembly Systems with Commodity Components
Greys Sosic, Associate Professor, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, United States of America, sosic@marshall.usc.edu, Mahesh Nagarajan

We study alliance formation between suppliers in an assembly model in which k suppliers sell commodity components, and the remaining suppliers are monopolists. In Stage 1, suppliers form coalitions that sell kits of components. In Stage 2, coalitions determine wholesale prices, while the assembler buys the kits and sets the product selling price. We predict the structure of stable alliances as a function of the power structure, the number of commodity/monopoly suppliers, and demand shape.

2 - Efficient Contracting in a Make-to-order Supply Chain with Asymmetric Information and Hidden Action
Yi Xu, Assistant Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, yxu@rhsmith.umd.edu, Wenqiang Xiao

We consider a supply chain where a retailer sells a product for a manufacturer. The manufacturer privately exerts effort to install capacity and has superior information about the product potential. We focus on the retailer's optimal design of incentive contracts facing this combination of adverse selection and moral hazard, and identify efficient contracts that allow the retailer to induce first-best effort at the same time extract all channel profit.

3 - Forecast Sharing in High-tech Capacity Procurement - The Incentive Structure
S. David Wu, Dean, College of Engineering, Lehigh University, 19 Memorial Drive West, Bethlehem, PA, 18015, United States of America, sdw1@Lehigh.EDU, Berrin Aytac

Motivated by high-tech capacity procurement practices, we study the effect of forecast sharing in this environment using a bargaining-theoretic model. The supplier and buyer interact in a dynamic setting with multiple demand and procurement updates, and different options for forecast sharing. Our analysis leads to insights concerning the buyer's incentive to invest in forecast-improving activities and to share this information truthfully.

4 - Risk Aversion and Supply Chain Contract Negotiation
Danko Turcic, Assistant Professor of Operations and Manufacturing Management, Washington University in St. Louis, Olin Business School, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu, Matthew J. Sobel

We employ the Nash bargaining solution to determine the value of an opportunity to negotiate a contract. Both firms have concave ordinal utility functions which allows us to model risk-aversion. We characterize the Nash-optimal contracts, and contrast the case where both firms are risk-neutral with the case where at least one of the firms is risk-averse. Risk aversion has a significant impact on the contract terms and one firm's risk aversion may be advantageous to the other.

■ WE40

H-Sapphire H, Fourth Floor

Behavioral Research in Operations and Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Srinagesh Gavirneni, Cornell University, sg337@cornell.edu

1 - Cognitive Factors and Performance in the Newsvendor Problem
Brent Moritz, PhD Candidate, Carlson School of Management, University of Minnesota, Minneapolis, MN, 55455, United States of America, morit022@umn.edu, Arthur Hill, Karen Donohue

Previous research shows that individuals use sub-optimal heuristics when selecting inventory quantities, as in a newsvendor problem. Cognitive factors, including reflection and dissonance, may explain these deviations and provide a theory of observed behavior. We test this with an experiment from experienced supply chain professionals. These results may impact task and system design, reward structures and selection of decision makers.

2 - Barriers to Safety Technology Adoption: An Employee's Perspective
David Cantor, Assistant Professor, Iowa State University, 2200 Gerdin Business Bldg, Ames, IA, 50011, United States of America, dnjcantor@gmail.com

Safety is a critical workplace issue in the United States. There are many challenges associated with creating a safe workplace. Providing employees with a voice in the process associated with the adoption of safety technologies to improve safety is of significant managerial, scholarly, and public policy interest. Drawing on procedural justice theory, we develop and offer a model to examine employee attitudes towards a proposed safety technology mandate by the U.S. government in the workplace.

3 - Trust in Forecast Information Sharing
Yanchong(Karen) Zheng, Stanford University, 380 Panama Way, Terman Engineering Center, Palo Alto, CA, 94305, United States of America, yczheng@stanford.edu, Ozalp Ozer, Kay-Yut Chen

We find in laboratory experiments that inter-party trust frequently leads to effective forecast information sharing via "cheap talk" in short-term relationship. Further experiments on repeated interactions reveal the evolution of trust over time and the impact of feedback on this evolution. We extend our initial behavioral model to a general framework, with which candidate models are compared and the Trust-Embedded Model are shown to be the most effective in explaining empirical observations.

4 - Contract Complexity and Performance under Asymmetric Demand Information: An Experimental Evaluation
Feryal Erhun, Assistant Professor, Stanford University, Terman Enineering Center, Room 305, Stanford, CA, 94305, United States of America, ferhun@stanford.edu, Kay-Yut Chen, Basak Kalkanci

We study the impact of contract complexity and asymmetric information on performance in human subject experiments. The supplier offers contracts which are common in practice yet differ in complexity to a newsvendor buyer with private demand information. Our results demonstrate that simpler contracts, either a price-only contract or a quantity discount contract with a limited number of price blocks, would be sufficient for a supplier designing contracts under asymmetric demand information.

■ WE41

H-Sapphire L, Fourth Floor

Detection and Deterrence

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

1 - Is Screening Cargo Containers for Smuggled Nuclear Threats Worthwhile?
Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W. Main Street, Box 843083, Richmond, VA, 23084, United States of America, lamclay@vcu.edu, Jason Merrick

US Customs and Border Protection plans to install radiation portal monitors to screen cargo containers at ports of entry into the United States. Recent research has called into question the value of routinely screening cargo containers, given the cost of installing and operating these devices and the cost of delaying cargo because of the frequent false alarms. We reexamine this decision by considering deterrence and objectives other than cost.

2 - How Have Terrorist Plots Really Been Foiled?
John Hollywood, Research Triangle Institute, 3040 Cornwallis Road, Research Triangle Park, NC, 27709, jhollywood@rti.org, Mark Pope, Kevin Strom

We conduct a qualitative analysis of cases of foiled terrorist plots to identify the warning signs that were most likely to lead to the discovery of terrorist activity. We find that most cases of terrorist activity were discovered through law enforcement reports of suspicious or illegal activity rather than intelligence reports.

3 - Characterizing Risk, Deterrence and Prevention
Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

We review recent controversies over how to characterize risk and present a general, mathematically rigorous definition. This readily yields formulas for the probability and benefit of deterrence. We suggest how these mathematical clarifications can guide data collection and interpretation by highlighting what makes a substantial difference in selected real situations.

■ WE42

H-Sapphire P, Fourth Floor

Topics in SCM

Contributed Session

Chair: Nagen Nagarur, Associate Professor, Binghamton University, Vestal Parkway, Binghamton, NY, 13850, United States of America, nnagarur@binghamton.edu

1 - Strategic Buyer-supplier Relationship Dissolution as Divorce: A Metaphorical Transfer
Yi-Su Chen, Doctoral Student, University of Minnesota, 3-150 Carlson School of Management, 321-19th Ave. S., Minneapolis, MN, 55455, United States of America, chen1276@umn.edu, M. Johnny Rungtusanatham

Strategic buyer-supplier relationship dissolution is often casually alluded to as a divorce. This casual invocation of the divorce metaphor has two drawbacks. To mitigate these two drawbacks, we conduct a formal metaphorical transfer of divorce as it relates to strategic buyer-supplier relationship dissolution and show equivalence between the two phenomena at the Ontology, Analogy, and Identity levels.

2 - Individual Choice, Social Optimization, and Incentive Scheme in Multisite Service Systems
Weixin Shang, School of Management, Fudan University, 670 Guoshun Road, Yangpu District, Shanghai, 200433, China, shangwx@fudan.edu.cn

We study the flow controls of a multisite service network. Uppon the arrival, a customer can either accept the service, or switch to another station, or reject the service. First, we characterize an individual's optimal behavior for minimizing his expected cost. Second, we discuss the optimal policy for minimizing the expected social cost. Third, we propose an effective static incentive scheme, under which customers make their individual choices while the expected social cost is near optimal.

3 - The Transportation Time Variance Intermodel Transfers in Freight Traffic: An Empirical Investigation
William Sawaya, Texas A&M University, 3367 TAMU, College Station, TX, 77845, United States of America, sawaya@tamu.edu, Chetan Reddy Mitta

Various transportation modes are used to transport freight, including ships, trucks, and railroads. This study investigates the variance in travel time of various modes as well as the variance of transfer times at intermodal transfers using empirical data on the movement of containerized goods along selected routes.

4 - Managing Demand Risks in Global Manufacturing Enterprise Using Marginal Substitution Pricing
Jie Ning, University of Michigan, 1205 Beal Avenue, IOE Building, Ann Arbor, MI, 48109-2117, United States of America, jien@umich.edu

We apply marginal indifference pricing to explicitly price demand risks a supplier takes when contracting with a manufacturer. We formulate a model based on monthly sales and production data from 2003 to 2008 between a Norwegian supplier and its 13 manufacturers in auto-industry. We study the risk price's dependence on business volatilities and correlation, and its sensitivity to supplier's utility. We then show that our model price significantly correlates with the realized contract price.

5 - Supply Chain Design From Business Models
Nagen Nagarur, Associate Professor, Binghamton University, Vestal Parkway, Binghamton, NY, 13850, United States of America, nnagarur@binghamton.edu, Ravi Ramrakyani, Swapnil Andhare

Many an enterprise has failed due to mismatch between its business model and supply chain design. A business model lets an organization define its main elements, from customer segments, cost structures to revenue generation. Hence these elements need to be considered in any design of a supply chain network. We propose a methodology, based on Quality Function Deployment, to successfully deploy supply chain components.

■ WE43

H-Room 400, Fourth Floor

Information Sharing in SCM

Contributed Session

Chair: Jianghua Wu, Assistant Professor, School of Business, Renmin University of China, Beijing, 100872, China, jwu@ruc.edu.cn

1 - Impact of Forecasting Method Selection and Information Sharing on Supply Chain Performance
Youqin Pan, University of North Texas, 1155 Union Circle #305249, Denton, TX, 76203, United States of America, Youqin.Pan@unt.edu, Robert Pavur

This paper investigates the impact of forecasting method selection on a supply chain consisting of one supplier and one retailer under different demand patterns via simulation.The findings can help supply chain managers select proper forecasting methods to improve supply chain performance.

2 - Optimization of Decentralized Supply Chains with Information Sharing and Manufacturer Competition
Mumtaz Bakan, Koc University, Adnan Kahveci Bulvari Cagdas Ap., N:97/11 B.evler/Istanbul, Istanbul, 34180, Turkey, mebakan@ku.edu.tr

The success of a supply chain system is dependent on its ability to integrate and coordinate the network of business relationships among its participants. In this study,the performance improvement of supply chain systems with decentralized optimization schemes is addressed. Furthermore the effect of information sharing, advance demand information and manufacturer competition on the performance with respect to profit and service level is analyzed.

3 - The Substitution Effect Between Information Sharing and Signaling Costs in Supply Chains
Noam Shamir, PhD Candidate, Graduate School of Business, Stanford University, 111/101 McFarland Ct., Stanford, CA, United States of America, nshamir@stanford.edu

We introduce a new motivation for information sharing - as a mechanism to reduce signaling costs. Competing retailers, endowed with private demand information, search for a mechanism to truthfully share their information. Two signaling games are analyzed: in the first, information is shared among the retailers, and in the second information is shared with their mutual manufacturer as well. We show how the exposure of the manufacturer to the information affects the retailers' signaling costs.

4 - Information Sharing in a Supply Chain with Learning Effect
Jianghua Wu, Assistant Professor, School of Business, Renmin University of China, Beijing, 100872, China, jwu@ruc.edu.cn

We study the impact of information sharing across decentralized retailers in a supply chain. The manufacturer supplies similar products to multiple retailers and each retailer serves its independent end market. We show that retailers have no incentives to share information about their private values when equilibrium order quantities are interior solutions. In addition, we show that the impact of information sharing is decreasing when there are more retailers?

■ WE44

H-Room 402, Fourth Floor

Retail Management

Contributed Session

Chair: Mahesh Kumar, Assistant Professor, University of Maryland, R.H. Smith School of Business, 4321 Van Munching Hall, College Park, MD, 20742, United States of America, mahkumar@rhsmith.umd.edu

1 - Setting Safety Stocks, Product Availability and Outdating Targets for Perishable Items

Karel van Donselaar, Assistant Professor, Eindhoven University of Technology, Postbus 513, Pav E3, Eindhoven, 2992GV, Netherlands, k.h.v.donselaar@tue.nl

In this paper we investigate how retailers can reduce outdating for perishable products. Hereto we first derive a formula showing how product availability depends on system parameters (product- and store characteristics) and the amount of outdating. Secondly we show how safety stock depends on system parameters and target product availability.

2 - Estimation of Unobservable Lost Sales and Substitution Rates for Perishable Products

Anna-Lena Beutel, University of Vienna, Department of Business Administration, Brenner Str. 72, Vienna, 1210, Austria, anna-lena.beutel@univie.ac.at, Stefan Minner

Perishable products require accurate demand forecasts to optimally determine order quantities. As a challenge, demand exceeding supply cannot be observed and customers who cannot find their first choice may purchase a substitute. We review and compare different methods for estimating unobservable lost sales as well as stock-out based substitution rates for multiple products and provide additional evidence from a large dataset of a major European retail chain.

3 - Entertainment Product Packaging for Distribution to Maximize Revenue

Bruce Wang, Professor, Texas A&M University, 3136 TAMU, College Station, TX, 77843, United States of America, bwang@tamu.edu, Yihua Li, Kai Yin

We study a problem in which a chain store selects from a large number of available products (e.g. DVDs) a subset to combine into packages to distribute to its local stores. We decide what products should be in each package and which package to distribute to each store for revenue maximization. Two heuristic methods are tested for the nonlinear sub-problem.

4 - Optimal Pooling to Improve Sales Forecasts for Retail Goods with Short Sales History

Mahesh Kumar, Assistant Professor, University of Maryland, R.H. Smith School of Business, 4321 Van Munching Hall, College Park, MD, 20742, United States of America, mahkumar@rhsmith.umd.edu

We present a model that recommends when it is beneficial to pool data from similar retail items in order to improve the accuracy of sales forecasts for these items. We find that in the beginning of a selling season, when there is only a small amount of historical sales information available for each individual item, pooling leads to improved forecasts. We show the effectiveness of our model on a series of data sets from leading US retailers.

■ WE45

H-Room 410, Fouth Floor

Contracts in Supply Chain Management

Contributed Session

Chair: Bong-Keun Jeong, University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, bjeong@uncc.edu

1 - A Comparison of Supply Chain Contracts with Effort Dependent Demand

Onur Kaya, Assistant Professor, Koc University, Rumelifeneri Yolu, Eng 206, Sariyer, Istanbul, 34450, Turkey, okaya@ku.edu.tr

We analyze the effort and pricing decisions in a two facility supply chain in which one of the parties can exert costly effort to increase demand. We analyze and compare several contracts for decentralized supply chain models and aim to find which contracts are best to use in different cases. We also compare the outsourcing and in-house production cases and also investigate the effect of the powers of the parties and the effect of system parameters on the performances of the contracts.

2 - Quantity Flexibility Contract under Dual Wholesale Price and Partial Refund Policy

Mahdi Zand, Robert H.School of Business, University of Maryland, College Park, MD, United States of America, mzd@rhsmith.umd.edu, Sanjay Jain

Motivated by improving the efficiency of supply chain, this paper streamlines performance of quantity flexibility (QF) contract by including dual wholesale price and partial refund policy. Our results indicate that inclusion of two mentioned clauses can coordinate and achieve Pareto optimality superior to a simple QF contract.

3 - Coordination of Decentralized Distribution System Through Over-forecast Compensation

Zhili Tian, PhD Student, Washington University in St Louis, P.O. Box 771, Chesterfield, MO, 63006, United States of America, tianzh@wustl.edu, Panos Kouvelis, Lingxiu Dong

In semi-conductor industry, some distributors inflate their forecasts to achieve high demand fill rate from the manufacturer. This results in high excess inventories in the system at the end of product life. We show that the over-forecast compensation contract coordinates the system and achieves Pareto optimum. We analyze the strategic interactions between the manufacturer and distributors and among distributors. We test the model at a leading manufacturer in the industry and report the results.

4 - The Impact of Piracy and Supply Chain Contracts on Digital Music Channel Coordination

Bong-Keun Jeong, University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, bjeong@uncc.edu, Moutaz Khouja, Kexin Zhao

We explore the impact of piracy on digital music supply chain profitability under different contract arrangements. Our findings indicate that the profit loss due to piracy depends on the type of consumer piracy risk and the type of contract. In addition, changes in consumer piracy risk not only change total chain profit but also change the distribution of profit between record label and retailer. We show that a fixed fee full transfer contract will always fully coordinate the supply chain.

■ WE46

H-Room 411, Fourth Floor

Technology Management

Contributed Session

Chair: Wiljeana Glover, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24073, United States of America, wjglover@vt.edu

1 - The Presence Ladder Model in the Console Game Industry

Jai Kim, Associate Professor, Sungkyunkwan University, 89-5, Chungwoon Dong, Chongro-Gu, Seoul, 110-130, Korea, Republic of, jaibeom@stanford.edu, Hosung Ahn, Samuel Chiu, Jiyong Eom

This study first introduces the notion of "presence" in the Neo-Schumpeterian perspective and thereby provides useful insights into the strategy in technology-based companies. Major innovations in the console game market have occurred with major changes in the degree of presence that console game systems can provide. Based on an in-depth historical industry study, we propose the presence ladder model, in which the evolution of the console game industry is divided into three generations.

2 - Optimization of LED Warranty

Oleg Bukhtiyarov, University of Alaska Anchorage, 727 Elm Street, 674, Anchorage, AK, 99501, United States of America, linousa@mail.ru, Hsueh-Ming Wang, LuAnn Piccard

This paper presents warranty estimation problem using a simulation approach. Warranty forecasting method based on stochastic iterations/infinitive games with dynamic change of product quality. Under a dynamic environment, simulation provides a warranty strategy for the market that maximizes their profit over time. And this paper describes optimal warranty strategy for LED technology in dynamic change.

3 - Study on the Evaluation of Talents Growth Based on Three-dimensional Capital Structure

Li Mo, Chinese Academy of Sciences, 3BNanyitiao, Zhongguancun, Haidian Distr, Beijing, 100190, China, jinyunmo@hotmail.com, Xia Xueqing

This paper first argues that Human Capital,Social Capital,Psychological Capital work together to decide the competitiveness of talents and measure the value of talents.Based on this,this paper establish an index system to evaluate the talents growth,construct a three-dimensional capital structure model,and use research methods like factor analyze and linear regression to test them by empirically study method,and establish the exponential equation for talents growth.

4 - Critical Success Factors for Sustaining Kaizen Event Outcomes
Wiljeana Glover, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24073, United States of America, wjglover@vt.edu, Eileen Van Aken

A major obstacle for many organizations is to sustain the results of a Kaizen event after it concludes. This field study research of Kaizen events across multiple manufacturing organizations provides evidence of how Kaizen event characteristics, work area characteristics, and sustainability processes may influence the sustainability of outcomes. The study also considers how the findings may inform future research of Kaizen events in service organizations.

■ WE47

H-Room 412, Fourth Floor

Pricing in Telecommunications

Contributed Session

Chair: Richard Steinberg, Chair in Operations Research, Department of Management, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, r.j.steinberg@lse.ac.uk

1 - Economic Analysis of Pricing Methods of Telecom Services
Ziyang Cheng, School of Economics and Management, Beijing University of Posts and Telecommunications, 422, No.8 Student Dormitory, BUPT, Beijing, 100876, China, chzy543@gmail.com, Shoulian Tang

According to the economic analysis of the two circumstances of the telecommunications businesses, which is based on realizing the maximum of social welfare and realizing the maximum of profits, this paper discusses the cost characteristics of the telecommunications businesses. This study shows that regulated, flexible discriminatory pricing based on the two-part tariff is the development trend of telecom services.

2 - Free In-network Pricing as Entry-deterrence Strategy
Tingting He, Assistant Professor in Marketing, University of Wisconsin-Milwaukee, P.O. Box 741, 3202 N. Maryland Ave., Milwaukee, WI, 53211, United States of America, he2@uwm.edu, Dmitri Kuksov, Chakravarthi Narasimhan

The paper analyzes the decisions of firms to provide free in-network pricing, measured and flat-fee plans. It aims to explain the emerging popularity of free in-network pricing. The results indicate in a competitive setting: without entry threat measured plan should be a natural outcome; with entry threat free in-network pricing alone, or together with measured or flat-fee plan can deter entry; and flat-fee plans cannot deter entry without free in-network pricing.

3 - Optimal Service Pricing
Ilona Murynets, PhD Student, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, imurynet@stevens.edu, Michael Zabarankin, Jose Ramirez-Marquez

An analytical model for a diffusion of a new service on a monopolistic market has been developed. The model accounts for an advertising and a word-of-mouth effect. An optimal dynamic pricing strategy includes a one-time installation fee and a subscription fee maximizing a total profit of a service provider over a given planning horizon. The optimal pricing strategy has been illustrated numerically.

4 - Pricing of Media Service Provision
Richard Steinberg, Chair in Operations Research, Department of Management, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, r.j.steinberg@lse.ac.uk, Peter Key

An Internet Service Provider offers basic Internet service plus additional media service, e.g., unlimited music downloads at a premium fee. What fees should it charge? We consider this question in a competitive setting involving two firms, one that offers basic Internet service, and one that offers both basic Internet service and the additional media service.

■ WE50

H-Room 302, Third Floor

Production and Scheduling II

Contributed Session

Chair: Mengying Fu, Doctoral Student, School of Computing, Informatics and Decision Systems Engineering, Arizona State University, Brickyard, Tempe, AZ, 85281, United States of America, Mengying.Fu@asu.edu

1 - Planning of Production Releases and Safety Stocks with Forecast Evolution
Amirhosein Norouzi, PhD Student, North Carolina State University, 2506 Avent Ferry Rd., Apt 103, Raleigh, NC, 27606, United States of America, anorouz@ncsu.edu, Reha Uzsoy

Our problem addresses the issue of production planning in the presence of workload-dependent lead times and stochastic demand. We propose a mathematical programming formulation based on chance constraints which captures load dependent lead times and the evolution of forecasts of stochastic demand over time. Computational results reporting the comparison of this approach to alternative approaches in the literature are presented.

2 - Multi-shift Production and Labor Capacity Scheduling
Babak Zafari, Graduate Assistant, Bowling Green State University, 514 E.Reed Ave., Apt 12, Bowling Green, OH, 43402, United States of America, zafari.babak@gmail.com, Christopher Rump

We consider the joint scheduling of labor resources and production tasks in a job shop, incorporating capacity requirement planning (CRP) within the material requirements planning (MRP) process. We propose a new mixed integer linear programming that incorporates job sequencing and constraints. We compare heuristic strategies to optimal decisions under a variety of performance metrics.

3 - A Hybrid Genetic Algorithm for Solving Invoice Printing Scheduling Problem
Yan Zhang, School of Management,Xi'an Jiaotong University, P.O.Box 2308,Xi'an Jiaotong University, Xi'an, China, yanerxh@gmail.com, Zhili Zhou

This research addresses a production scheduling problem in the multi-page invoice printing system. The system comprises of a stencil preparation stage, a page printing stage and an invoice assembly stage. The objective is the minimization of the makespan for all the invoice orders. A hybrid genetic algorithm (HGA) is proposed and a lower bound for the makespan is developed. Numerical experiment indicates that our HGA can solve the problem efficient and effective.

4 - Capacity Models for Multistage Production Systems with Parallel Processors
Mengying Fu, Doctoral Student, School of Computing, Informatics and Decision Systems Engineering, Arizona State University, Brickyard, Tempe, AZ, 85281, United States of America, Mengying.Fu@asu.edu, Ronald Askin, John Fowler, Naiping Keng

We propose an integrated scheduling formulation for a multistage flexible flowshop problem with parallel processors, significant setup times at certain stages, and late-stage product substitution options. A linearized approximation is used for obtaining computationally feasible solutions for large instances. The optimization model is interfaced with a simulation to eliminate feasibility considering additional details and scenarios.

■ WE51

H-Room 303, Third Floor

Threat Detection for Homeland Security

Contributed Session

Chair: Ron Billings, CEO, FABQ.com, 280 NE Cambridge Circle, Corvallis, OR, 97330, United States of America, profbillings@gmail.com

1 - Sensor Network Optimization for Threat Detection
Anton Molyboha, Postdoctoral Associate, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, amolyboh@stevens.edu, Michael Zabarankin

A Markov chain approach to optimal coverage problem for threat detection by a sensor network in a noisy environment has been developed. The approach has been illustrated in application to diver detection in an urban harbor.

2 - Identifying Vulnerabilities Using Sensors Information
Monica M. De Marchi, Dra, Institute for Advanced Studies/General Command for Aerospace Technology, Rod dos Tamoios, km 5,5, Sao Jose dos Campos, SP, 12.228-001, Brazil, monica@ieav.cta.br, Maria Jose P. Lamosa, Carmen Lucia R. Santos

In this work methods of optimization are used to support the decision making process by giving information about the coverage area by sensors such as radars and cellular antennas. The aim is to provide indicators to help the decision makers to identify vulnerabilities in a given area. Some examples of scenarios where the research could be applied and the methodology used until now are presented.

3 - Discovering Radicalization Using Social Movement Theory, Argumentation Theory and Systems Dynamics
Dennis Engi, Professor, New Mexico State University, Box 30001/MSC 4230, Las Cruces, NM, United States of America, engi@nmsu.edu

The research described in this paper enabled analysts to develop a conceptual framework for understanding, recognizing, and anticipating the origins, dynamic mechanisms, perceptions, and social structures of social reform movements in the homeland and in Diaspora communities. The authors propose that Social Movement Theory combined with Systems Dynamics and Argumentation Theory can provide an extensible foundation for helping anticipate and potentially prevent terrorist actions.

4 - Maritime Simulation Analysis of Radiological and Nuclear Threats
Daniel Faissol, Postdoctoral Researcher, Lawrence Livermore National Laboratory, 7000 East Ave., L-227, Livermore, CA, 94550, United States of America, dfaissol@llnl.gov, Thomas Edmunds, Matthew Dombroski, Yiming Yao

We summarize simulation analysis of radiological and nuclear threats from small vessels that are directed towards, or transit, U.S. ports. Due to the complex dynamics of search patrols in the harbor, benign vessels that must be screened, radiation transport phenomena, detection algorithms and concepts of operations (CONOPS), a simulation model is required to evaluate the efficacy of a given countermeasure architecture and enumerate design trade-offs.

5 - The Telegraph Patrol: Optimal Strategies for the Use of Randomness in Patrolling and Scanning
Ron Billings, CEO, FABQ.com, 280 NE Cambridge Circle, Corvallis, OR, 97330, United States of America, profbillings@gmail.com

Often a fixed path needs to be patrolled (by a ship, aircraft, ground vehicle, or video camera), but the movement along the path needs to be difficult for a potential infiltrator to predict. If the patroller reverses direction according to a Poisson process, this gives the least information to an observer. We analyze infinite lines, closed loops, or open line segments (and discuss more complicated scenarios); and derive optimal values for reversal rates.

■ WE52

H-Room 304, Third Floor

Forecasting and Simulation Models

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Casey Chung, Director, Blockbuster Distribution, 3000 Redbud Blvd, McKinney, TX, 75407, United States of America, casey_chung@msn.com

1 - A Sales Forecast Model for Short-life-cycle Products: New Releases at Blockbuster
Casey Chung, Director, Blockbuster Distribution, 3000 Redbud Blvd, McKinney, TX, 75407, United States of America, casey_chung@msn.com, Shun-Chen Niu, Chelliah Sriskandarajah

We build upon a stochastic generalization of the Bass Model to forecast sales at Blockbuster. We assume that there are three sales components, from committed buyers, potential buyers, and networking effect. We explicitly formulate into our model dynamic interactions between these sales components, both within and across sales periods. The model is thoroughly tested against sales data from Blockbuster and our empirical results show that the model offers excellent fit to actual sales activity.

2 - How a Supply Chain Exerts Costly Effort to Improve the Quality of Its Forecasting Capability
Xiaowei Zhu, West Chester University of PA, 312A Anderson Hall, West Chester, PA, United States of America, XZhu@wcupa.edu, Xiaohang Yue, Samar Mukhopadhyay

We analyze several forecast systems and their impact on forecast accuracy, forecast costs and profit. Specifically, we consider a supplier who sells a product to a buyer in a single selling season. Three different forecast systems, namely, Non-Information Sharing, Information Sharing, and Supplier Forecasting were studied. We derive optimal price and forecast accuracy level and discuss forecast variance and the related forecast costs.

3 - Predicting Donations for A Charity Organization: A Direct Marketing Case Study
Gary H. Chao, Kutztown University, 15200 Kutztown Road, Kutztown, PA, 19530, United States of America, chao@kutztown.edu, Maxwell K. Hsu

Charity organizers increasingly attempt to estimate the fundraisings with the intention of better allocating the future expenditures. This paper contributes to the study on donor lifetime value by proposing how to predict future contributions using historical data. Models are evaluated in terms of their prediction error, success rate and accuracy rate. Based on the empirical findings, practical implications are offered for fundraisers to more accurately predict donors' future donations.

4 - Simulation Sells - Using Modeling to Market Products
Rainer Dronzek, Operations Research Director, McDonaldís Corporation, 1253 N Schmidt Road, Romeoville, IL, 60606, United States of America, rainer.dronzek@us.mcd.com, Alison Knight

Simulation modeling is not limited to troubleshooting problems or analyzing systems. If properly structured, models can be transitioned to a sales force to help them predict how systems function in a customer's environment. This session includes examples of models in a variety of industries that started as analysis tools and migrated to the sales organization. Discussions will include how to tailor models for the sales user, centralized models, and architecture considerations.

■ WE53

H-Room 305, Third Floor

Knapsack Problems and Applications

Contributed Session

Chair: Osman Oguz, Associate Professor, Bilkent University, Bilkent University, Ankara, 06800, Turkey, ooguz@bilkent.edu.tr

1 - Improved Sbihi's Algorithm to Solve the Multidimensional Multiple-choice Knapsack Problem
Cheng-Huang Hung, Assistant Professor, National Taiwan University of Science and Technology, 43, Sec. 4, Keelung Rd., Taipei, Taiwan - ROC, alexhung@cs.ntust.edu.tw, Wun-Ting Huang

Sbihi develops an exact algorithm using branch and bound with best-first solution to solve the Mutlidimensional Multiple-Choice Knapsack Problem. This study proposes two algorithms by modifying Sbihi's algorithm with tighten upper bounds. This work tests the performance of algorithms on Khan's and Sbihi's instances. Computational results show that modified algorithms are more efficient than Sbihi's. Modified algorithms are also faster than CPLEX in small or median instances.

2 - An Investment Game for Two Persons
Lan Li, NC State University, 509-21 Tartan Circle, Raleigh, NC, 27606, United States of America, lli2@ncsu.edu

In this game, two investors, each with an individual budget, bid on a common pool of potential projects which are gathered to be selected as some "project sets". Associated with each project in each set, there is a potential market profit that can be taken by the only bidder or shared proportionally between both bidders. We show that a pure Nash equilibrium exists under certain conditions. Moreover, we design a dynamic programming based algorithm to find such a state.

3 - Solving Continuous Quadratic Knapsack Problem Using Efficient Pegging Algorithm and Matrix Splitting
Gitae Kim, Graduate Student, Kansas State University, 2033 Durland Hall, Kansas State University, Manhattan, KS, 66506, United States of America, gitaekim@ksu.edu, Chih-Hang Wu

We propose an efficient pegging algorithm for solving continuous quadratic knapsack problem with box constraints. Our proposed dual bound algorithm checks the bound constraints with the bounds of Lagrange multiplier corresponding to primal variables without calculating primal variables at each iteration. We also used matrix splitting method with nonmonotone line search to solve the problem with dense Hessian matrix. Experimental results have shown good solution time comparing with Bitran-Hax.

4 - Release Planning for Software Product Lines
Jaewook Yoo, Senior Engineer, Samsung Electronics, San # 14-1 Nongseo-dong, Giheung-gu, Yongin-si, yeonggi-do, 446-712, Korea, Republic of, jay4646.yoo@samsung.com

An optimization methodology is developed for assigning the most cost-effective features to releases for software product lines. A precedence constrained multiple knapsack problem is formulated. To solve the problem exactly, we present a pegging approach, where the size of the original problem is reduced by applying the Lagrangian relaxation followed by a pegging test.

5 - On a Class of Polynomially Solvable 0-1 Single Dimensional Knapsack Problems
Osman Oguz, Associate Professor, Bilkent University, Bilkent University, Ankara, 06800, Turkey, ooguz@bilkent.edu.tr

We present a method to generate 0-1 single dimensional knapsack problems that can be solved in O(n3) time and O(n2) space for any value of n; the number of 0-1 variables. Then, we try to use them as easily solvable sub-problems as part of more general 0-1 programming problems. Results from some numerical experimentations are also be provided.

■ WE54

H-Room 306A, Third Floor

Compressed Sensing: Theory and Applications

Sponsor: Optimization/Networks
Sponsored Session

Chair: Rahul Garg, IBM TJ Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, grahul@us.ibm.com

1 - Compressed Sensing Applications in MRI
Mark Griswold, Associate Professor, Case Western Reserve University, 11100 Euclid Ave, MRI Research - Bolwell B121, Cleveland, OH, 44106, United States of America, Mark.Griswold@uhhospitals.org, Nicole Seiberlich, Vira Chankong, GQ Zhang

MRI is a leading medical imaging modality. MRIs primary drawbacks are limited sensitivity and speed. Compressed sensing (CS) has the potential to greatly improve both of these areas. However, it is not trivial to apply CS to MRI data. Here we will focus on real-life clinical examples of how CS has been successfully applied to MRI and discuss potential areas of future development. In particular, we will focus on naturally sparse imaging (eg angiography) where significant gains have been achieved.

2 - Compressed Sensing in Magnetic Resonance Imaging
Ali Bilgin, Assistant Professor, University of Arizona, 1230 E Speedway Blvd, Tucson, AZ, 85721-0104, United States of America, bilgin@ece.arizona.edu

Magnetic Resonance Imaging (MRI) is a non-invasive imaging method that has shown great promise in studying the structure and function of the body. However, long data acquisition times make MRI less practical in certain cases and impossible in others. We will discuss how compressed sensing (CS) theory has been utilized to accelerate MRI in several applications. We will point out the unique requirements and challenges of each application and discuss technical limitations and clinical concerns.

3 - Recursive Reconstruction of Sparse Signal Sequences
Namrata Vaswani, Assistant Professor, Iowa State University, 3121 Coover Hall, Ames, IA, 50010, United States of America, namrata@iastate.edu

We will overview our recent work on recursive algorithms for causally reconstructing a time sequence of (approximately) sparse signals from a small number of "incoherent" linear projections. Potential applications include real-time dynamic magnetic resonance imaging (MRI), real-time single-pixel video imaging and video compression. By exploiting the fact that sparsity patterns change slowly over time, we formulate this problem as one of compressive sensing with partially known support.

4 - Sparsity Controlled Optimal Experimental Design for Non-linear Ill-posed Problems
Lior Horesh, Dr., IBM Watson Research Center, 32 -243, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, lhoresh@us.ibm.com, Eldad Haber, Luis Tenorio

We review some of the conventional approaches for optimal experimental design and highlight their theoretical shortcomings when dealing with ill-posed problems. Then a statistically sound algorithmic methodology for optimal experimental design of non-linear, ill-posed problems is introduced. We present the utilization of this approach for large-scale, non-linear electromagnetic inversion problems, and compare it with traditional and linear experimental designs.

■ WE55

H-Room 306B, Third Floor

Auctions

Contributed Session

Chair: Mingzhou Jin, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, mjin@ise.msstate.edu

1 - Equilibrium in Parallel On-line Auctions
Rodrigo Garrido, Dr., Catholic University of Chile, Vicua Mackenna 4860 Macul, Santiago, Chile, ragarrid@uc.cl

There are two parallel on-line auctions. The primary auction is the marketplace for trading an item. The secondary auction is the marketplace to procure transportation for the item. Buyer has a budget to pay for both the item and its transportation; hence equilibrium price at both auctions is interrelated. Analytical results are presented for the equilibrium prices at both marketplaces, assuming that all the bids follow a Gumbel process, and they arrive in a Poisson manner to the marketplace.

2 - Auctions for Targeted Television Advertising
Mark Zschocke, University of Waterloo, 200 University Avenue West, Waterloo, On, N2L 3G1, Canada, zschocke@gmail.com

A new technology will allow television advertisers to target demographic groups directly and in real-time. This presentation explores the new decision-making required by this technology and how the television advertisement space can be sold effectively. In particular, it compares a list price system to the Vickrey-Clarke-Groves (VCG) mechanism as well as new auction models that lead to similar outcomes but require less computational effort.

3 - Sequential Auctions in a Duopoly Market with Constrained Supply Capacity
Mingzhou Jin, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, mjin@ise.msstate.edu

This paper analyzes sequential auctions in which two major suppliers compete for procurement contracts. Each supplier faces constrained supply capacity so that the suppliers in the first auction have to make decisions considering demand uncertainty from the second buyer. Analytic sufficient conditions of suppliers' optimal strategies are derived. The impacts of market characteristics on payoff of the buyers and suppliers and price tendency are empirically studied.

■ WE56

H-Room 307, Third Floor

Pricing Digital Goods

Contributed Session

Chair: Ziping Wang, University of Bridgeport, 126 Park Ave, Bridgeprot, CT, 08804, United States of America, zipingw@bridgeport.edu

1 - Software Pricing and Openness under Competition
Hazhir Rahmandad, Assistant Professor, Virginia Tech, 7054 Haycock Road, Room 430, Falls Church, VA, 22043, United States of America, hazhir@vt.edu, Sinan Aral

Commercial firms seek boosting profitability through opening their software to get free contributors and complementary products. Yet openness limits the price that can be charged and strengthens network effects. We explore optimum pricing and openness for two firms in competition. Reinforcing loops increase the value of early market lead, pushing both players towards highly open software products with deep early discounts, which may significantly compromise the profitability of the players.

2 - Advance Selling of Services Through Infomediaries
Zafer Ozdemir, Miami University, Upham Hall 308C, Oxford, OH, 45056, United States of America, ozdemir@muohio.edu, Tolga Akcura, Mohammad Rahman

This research analyzes the motivational differences and pricing strategies in adopting Internet infomediaries for quality differentiated service providers. Why does a high quality service provider adopt a Shopbot or an infomediary and how does the motivation differ compared to a low quality service provider? What are the implications of adopting such services on pricing strategies, service differentiation, and consumer welfare?

3 - Pricing Digital Goods with Externality
Paul (Jinxiang) Pei, Northwestern University, 2145 Sheridan Rd. 229, Evanston, IL, 60208, United States of America, peipauj@u.northwestern.edu, Diego Klabjan

We consider the case of buyers exposed to externalities such as incurring a monetary penalty of potentially not buying the goods. We study two different perspectives: an auction setting, and a fixed price selling arrangement.

4 - Bayesian Pricing Strategy for Information Goods
Ziping Wang, University of Bridgeport, 126 Park Ave, Bridgeprot, CT, 08804, United States of America, zipingw@bridgeport.edu, Dong-Qing Yao, Samar Mukhopadhyay

We studied Bayesian pricing strategy for subscription-based information goods with uncertain demand. Considering the changing environmental issues, it is almost impossible to perfectly estimate the demand for information goods which have a short life cycle. We discussed such multi-period problem by a discrete time stochastic model. The solution of the problem involved a dynamic programming formulation and backward induction. We presented a Monte Carlo based approach to solve the problem.

■ WE57

H-Room 308, Third Floor

Quality Management II

Contributed Session

Chair: Charles Harrell, Associate Professor, Brigham Young University, 265 CTB, Provo, UT, 84602, United States of America, harrellc@byu.edu

1 - Managing Process-based New Product Development: Team Leader's Expertise, FMEA and Performance
Komsan Sanongpong, Mr., Assumption University of Thailand, 36/1 Sunthonwohan Rd., Klaeng, 21110, Thailand, komsan.sanongpong@gmail.com

The new product development in the automotive industry, within the context of ISO/TS16949:2002, typically consists of certain phases. These may be done concurrently and have correlated activities. This paper proposes NPD process-based management concept focusing on relation between team leader's technical expertise and FMEA application effectiveness, and NPD performance.

2 - The Relationships Among Satisfaction, Trust, and Commitment: The Comparisons of Various Theoretic Models

Hui-Hsuan Liu, National Cheng-Kung University, 1, University Road, Tainan, Taiwan - ROC, mimi73718@gmail.com, Yung-Ming Shiu

Satisfaction, trust and commitment are often discussed in the relationship quality, but previous researches only adopted two variables of the three variables to discuss, there is no conclusion about that. The study uses empirical data and develops eight different theoretic models to test various theoretic models in order to find out the best model. Empirical results indicate that the best model is that satisfaction would positively influence trust and commitment, trust would positively influence commitment. The study provides some suggestions in practices and future directions.

3 - Evaluation of the Use of Control Letters X EWMA and CUSUM in a Quality Control

Rita Penabaena, Universidad del Norte Barranquilla-Colombia/ University of South Florida, 4202 E.Fowler Ave., Tampa, Fl, 33620-5350, United States of America, rpena@uninorte.edu.co

Due to the globalization, the organizations have oriented their strategies made the improvement of the quality and to the reduction of the manufacture's costs. The present investigation looks for to detect the situations outside control that can presented when control a process and to make oriented decisions to improve the quality and to diminish the costs associated to the same one.

4 - Leveraging Lean Six Sigma with Simulation

Charles Harrell, Associate Professor, Brigham Young University, 265 CTB, Provo, UT, 84602, United States of America, harrellc@byu.edu

Lean Six Sigma (LSS) has become the de facto methodology for improving business processes around the globe. Many LSS practitioners have discovered, however, that determining what changes to make is not always easy. This paper shows how simulation, with its powerful predictive and visualization capabilities, eliminates the risk of making suboptimal or misguided process improvement decisions. Case studies in both manufacturing and healthcare illustrate typical problems and their solution.

■ WE60

H-Room 311, Third Floor

Robust Optimization

Contributed Session

Chair: Apostolos Fertis, PhD Candidate, MIT, 70 Pacific Str, Apt # 927, Cambridge, MA, 02139, United States of America, afertis@mit.edu

1 - Using Robust Optimization in Banking Industries

Kevin Fleming, Scientist I, FICO, 200 Smith Ranch Road, San Rafael, CA, 94903, United States of America, kevinfleming@fico.com, Brendan Del Favero, Frank Elliott, Alkis Vazacopoulos

Robust optimization refers to optimization with non-probabilistic uncertainty in the coefficients of the objective function and global constraints. These problems arise in new or changing markets because of the lack of historical data necessary to characterize the uncertainty as a probability. We present an implementation of robust linear programming that improves on previous techniques in both running time and optimality, and can be used to solve real, current problems in banking industries.

2 - Robust Optimization in AIMMS

Marcel Hunting, Paragon Decision Technology, Schipholweg 1, Haarlem, 2034 LS, Netherlands, Marcel.Hunting@aimms.com

The AIMMS modeling language will be extended such that a robust optimization model can be generated from any given deterministic model, without the need to reformulate the deterministic model. By only supplying additional attributes for selected parameters, variables and constraints, AIMMS can generate both a deterministic and robust optimization model from the same formulation.

3 - A New, Intuitive and Industrial Scale Approach Towards Uncertainty in Supply Chains

Abhilasha Aswal, Associate Technical Evangelist, Infosys Technologies Limited, 26/C Electronics City, Hosur Road, Bangalore, KA, 560100, India, abhilasha_aswal@infosys.com, G.N. Srinivasa Prasanna

This unique & industrial-scale robust-optimization approach bounds parameters in polytopes built from economically meaningful linear constraints. A set of parameter assumptions (SA) is a polytope. Polytope relational algebra determines if different SAs are the same, totally different, or have common assumptions. SA information content is polytope volume, enabling comparison/equivalencing of SA's based on information-content, comparison of information content of output w.r.t input, etc.

4 - An Operational Learning Approach to Portfolio Optimization

Ankit Jain, U.C. Berkeley, Berkeley, CA, 94709, ankit@ieor.berkeley.edu, Andrew Lim, J. George Shanthikumar

We consider mean variance portfolio optimization problem. Classical approaches are known to perform poorly out of sample in the presence of estimation error. We introduce a new approach that guarantees a better out of sample performance than classical one. We explore the link between our approach and minimum norm portfolio. We reformulate the problem as a semidefinite program and show numerical results.

5 - Robust Maximum Likelihood

Apostolos Fertis, PhD Candidate, MIT, 70 Pacific Str, Apt # 927, Cambridge, MA, 02139, United States of America, afertis@mit.edu, Dimitris Bertsimas, Omid Nohadani

We use robust optimization to define robust maximum likelihood estimators that deal with uncertainty. We model errors both as deterministic and stochastic variables. In case of stochastic variables, we prove that the resulting optimization over measures problem has the same solution as an optimization over deterministic decision variables problem. We develop efficient algorithms to compute the robust estimators for the multivariate normal distribution and show their effectiveness numerically.

■ WE63

H-Room 314, Third Floor

Therapy and Treatment Models in Health Care

Contributed Session

Chair: Gorkem Saka, Health Economist, Merck Research Labs, Merck & Co., Inc., Upper Gwynedd, PA, United States of America, gorkem_saka@merck.com

1 - Optimization Models to Identify Protein Biomarkers for Ovarian Cancer Diagnosis

Chaitra Gopalappa, PhD Candidate, Industrial Engineering, University of South Florida, 4202 E Fowler Ave., Tampa, FL, 33613, United States of America, chaitra@mail.usf.edu, Tapas Das

We develop an optimization model for identifying significant proteins for ovarian cancer diagnosis. Protein data is obtained using Protein Fractionation- 2 Dimension (PF2D). Translating PF2D output to protein expression values requires considerable amount of mathematical analysis, which is currently lacking in literature. We address this void by developing mathematical and optimization models for extracting protein expression values.

2 - The Impact of Rolofylline on Patients Hospitalized for Acute Decompensated Heart Failure (ADHF)

Gorkem Saka, Health Economist, Merck Research Labs, Merck & Co., Inc., Upper Gwynedd, PA, United States of America, gorkem_saka@merck.com, John R Cook, Hemant M. Phatak, Ruifeng Xu

ADHF is the rapid onset of symptoms and signs secondary to abnormal cardiac function. Worsening renal function (WRF) experienced during an ADHF hospitalization affects outcomes significantly. We developed a Markov model to explore Rolofylline impact on probability of WRF, length of stay, mortality and rehospitalization rates for ADHF patients with renal impairment. Health care resource utilization and the impact of Rolofylline on outcomes were estimated based on a randomized controlled trial.

■ WE66

H-Room 204A, Second Floor

Network Optimization II

Contributed Session

Chair: Sean McGarraghy, Lecturer, University College Dublin, Quinn School of Business, Belfield, Dublin 4, Ireland, sean.mcgarraghy@ucd.ie

1 - Computational Grid Networks Market Design. QoS, Reliability, Efficiency and Risk Management

Jose Cruz, Assistant Professor, University of Connecticut, School of Business, Storrs, CT, United States of America, jcruz@business.uconn.edu

In this paper we develop a network equilibrium model for optimal pricing and resource allocation for Computational Grid Network. We introduce risk management into the decision making process by analyzing the decision-marker's reliability and quality of service (QoS) requirement. The proposed framework determines an efficient grid resource allocation as well as the equilibrium market price patterns based on demand, supply, and cost structure of the grid computing market network.

2 - Optimization Over Scale-free Networks
Matthew Fontana, Massachusetts Institute of Technology, Operations Research Center, MIT, 77 Massachusetts Ave, Bldg E40-130, Cambridge, MA, 02139, United States of America, mfontana@mit.edu, Thomas Magnanti

We review the emerging field of network science and provide an optimization-based perspective by conducting computer experiments for shortest path and minimum spanning tree problems over Barabasi-Albert scale-free graphs with Euclidean and uniform random weights. For Euclidean weights, the average path length and weighted diameter are large enough to suggest that the graphs have special structure. We also present a spanning tree heuristic for these graphs by exploiting their structure.

3 - Optimizing Routes for Multimodal Shipping Containers
EunSu Lee, PhD Student, North Dakota State University, Transportation and Logistics Program, Fargo, ND, 58105, United States of America, eunsu.lee@ndsu.edu

Container shippers in the Northern Great Plains spend more for drayage to carry containers since railroad terminals are operated by a hub-and-spoke system. In this model, the total cost is minimized for multimodal transportation. When the railroad company removes the blocking constraint en route, total cost was reduced.

4 - The Ring Spur Assignment Problem and Telecommunications Networks
Sean McGarraghy, Lecturer, University College Dublin, Quinn School of Business, Belfield, Dublin 4, Ireland, sean.mcgarraghy@ucd.ie, Paula Carroll

We describe the Ring Spur Assignment Problem (RSAP), arising in the design of survivable Next Generation Networks. The aim is to cluster communities on node disjoint local rings of few hops (with spurs if necessary), and connect local rings by a backbone ring. We relate this to problems previously addressed in the literature and give an IP model suitable for solving small problem instances. We outline a cutting plane algorithm for larger problem instances and present some computational results.

■ WE68

H-Room 206, Second Floor

Algorithmic Developments in Stochastic Optimization II

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu

Co-Chair: Lewis Ntaimo, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

1 - Fenchel Decomposition for Stochastic Integer Programming
Lewis Ntaimo, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

In this talk, we present a new cutting plane method for two-stage stochastic integer programs called Fenchel decomposition (FD). FD is based on a new class of valid inequalities termed, FD cuts, which are based on Fenchel cutting planes in integer programming. We consider FD cuts based on both the first- and second-stage variables, and based only on the second-stage variables. Preliminary computational results with instances from the literature will be presented.

2 - Risk Classification Approach Through Convex Optimization
Vladimir Bugera, Kammerdiner Consulting, 16031 N 31st AVE, Phoenix, AZ, 85053, United States of America, vladimir@bugera.com, Stan Uryasev

We consider an optimization approach for multi-class classification. The optimization problem is formulated as minimization of a penalty function built with quadratic separating functions. It is reduced to linear programming problem for finding parameters of optimal classification. We apply this approach to evaluate risks in several financial applications, and compare our methodology with conventional techniques.

3 - Algorithmic Development on a Class of Stochastic Quadratic 0-1 Programs
Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu, Zhen Zhu

We, in this paper, study a class of two-stage stochastic quadratic programming problems with 0-1 variables on both stages. We apply a branch-and-fix framework and adapt various decomposition methods, together with a number of linearization techniques within this framework. Analytical and computational results will be presented for the comparison of different methods.

■ WE73

H-Indigo E, Second Floor

Managing Disruptions in Supply Chains

Contributed Session

Chair: Shanshan Wang, PhD Student, Arizona State University, School of CIDSE, Tempe, AZ, 85281, wshanshan@asu.edu

1 - Analysis of Stochastic Disruptions to Support: Design of Capacitated Engineered Networks
Andres Uribe, University of South Florida, 4202 E. Fowler Ave, Tampa, FL, 33620, United States of America, auribe@mail.usf.edu, Alex Savachkin

We examine stochastic capacity and demand disruptions on a variety of production supply networks via flow-matching networks.We examine probability law on available effective capacity of such networks, in the presence of random capacity propagation delays. We integrate stochastic dynamics of demand and capacity to calculate expected utility as parameter to selection of the best network design.

2 - A Dynamic Simulation Approach to Integrated Supply Chain Monitoring
Shanshan Wang, PhD Student, Arizona State University, School of CIDSE, Tempe, AZ, 85281, wshanshan@asu.edu, John Fowler, Teresa Wu

Supply Chain is vulnerable to internal and external disruptions, which could cause severe lost (financial, reputation, business opportunities, etc). However, it is difficult to identify an undergoing disturbance and predict the system status of a supply chain due to the fact that it is complex, dynamic and loose-coupled. It is known that simulation is a promising tool to monitor the supply chain states. Here we propose a dynamic simulation approach to monitor the real-time supply chain performance by fusing data stream from simulation and emulation through Extended Kalman Filtering and Ensemble Kalman Filtering. The experiments show that our approach well track the evolving of supply chain states even with incomplete and noised information.

■ WE74

H-Indigo H, Second Floor

Risk Modeling in Energy Markets

Contributed Session

Chair: Cigdem Gurgur, Professor, Purdue University, Doermer School of Business & Management, 2101 Coliseum Blvd. East, Ft. Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu

1 - A Mean-variance Model for Risk Premia Characterization in Electricity Markets
Virginia Gonzalez, PhD Student, University Castilla-La Mancha, Camilo Jose Cela s/n, Ciudad Real, Spain, virginia.glez.lopez@gmail.com, Javier Contreras

This paper seeks to explore the dynamics of various peak and baseload Electricity Risk Premia in different trading periods, and over different maturities. We developed a mean-variance optimization model, and characterise the behaviour in Risk Premium with a multivariate GARCH modelling approach.

2 - CVAR-constrained Multi-period Power Portfolio Optimization with Transmission Considerations
Cigdem Gurgur, Professor, Purdue University, Doermer School of Business & Management, 2101 Coliseum Blvd. East, Ft. Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu, Emily Klawon Newes

The deregulation of electricity industries is introducing risk and uncertainty into a sector of the economy that was traditionally state regulated. In order to manage the risk from market prices, consumers and producers use financial methods to support decentralized decision making under uncertainty. In this research, optimization of portfolios of real and contractual assets, including derivative instruments in a multi-period setting is considered in which transmission constraints also exist.

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MD54 Approximation and Online Algorithms
MD55 Supply Chain Risk Management and Multiple Sourcing
MD56 Optimization and Equilibrium Problems: Theory, Distributed Algorithms and Decomposition Schemes
MD57 OR in Public Health
MD58 Solving Response Time Variability Problems
MD59 Tutorial: Cutting Plane, Cutting Surface, and Subgradient Methods
MD60 Geometric Aspects of Optimization
MD61 Facility Location and Network Design Models
MD62 Differing Perspectives and a Critical Review of Behavioral Ops
MD63 Health Care Service Delivery Design
MD64 Undergraduate Research Showcase
MD75 Train Scheduling

Tuesday, 8:00am - 9:30am

TA01 Portfolio Decision Analysis I
TA02 Value of Information
TA03 Integrated Methodologies for MCDA
TA04 Joint Session ICS/DM Optimization in Data Mining/Machine Learning
TA05 Operations and Management in Energy Industry I
TA06 IEEE Transactions on Automation Science & Engineering Sponsored Session
TA07 Quality Control for Nanomanufacturing
TA08 Pervasive Data Mining
TA09 Applications of Queueing Theory
TA10 Joint Session APS/Inventory Management: Analysis of Stochastic Inventory System
TA11 Service Operations
TA12 Computation Models of Air Transportation Management
TA13 Optimization and Complex Stochastic Systems
TA14 Optimization in Practice III - Logistics
TA15 Software Demonstrations
TA16 Online Communities and Consumer Behavior in eCommerce Research
TA17 Social Interactions in Business: Models and Processes
TA18 Network Design in Telecommunications
TA19 Routing Behavior and Traffic Assignment
TA20 Fleet Redistribution
TA21 Methods and Models for Road Pricing II
TA22 Warehouse Operations I
TA23 Defense Supply Chain Issues
TA24 Newsvendor Economics
TA25 Airport Operations II
TA26 Edelman Finalists Reprise - II
TA27 Simulation in Health Care II
TA28 Cooperation and Competition in Networks
TA29 Simulation Models in Energy Markets
TA30 Open Pit Mine Planning, I
TA31 Pricing and Revenue Management: Beyond Revenue
TA32 Financial Risk Measures: Properties and Extensions
TA33 Incentives in Supply Chain Design
TA34 Disaster Preparedness and Response
TA35 Game Theoretic Applications in Healthcare I
TA36 Optimization of Patient Scheduling Under Uncertainty
TA37 Capacity Investment and Pricing Decisions in Operations Management
TA38 Empirical Research in Inventory Management
TA39 Models for Managing Upstream Supply Risk and Information Asymmetry
TA40 Inventory Management of Substitutable Products
TA41 Joint Session SPPSN/LA/MIF: Community-Oriented Operations Research
TA42 Joint Session Wagner/CPMS: Announcement of the Wagner Prize Winner
TA43 Approximation Algorithms for Stochastic Inventory Control Problems
TA44 Educating Students in Service Sciences Panel Session
TA45 Strategies for Managing Incremental and/or Radical Innovation
TA46 Modularity in Business Models, Processes and Logistics

TA47 New Frontiers in Global Sourcing
TA48 Service Design and Strategy
TA49 Contingent Efficiency of Global Supply Chain and Logistics
TA50 Sports and Entertainment
TA51 Integer Programming
TA52 Strategic Models of Marketing and Operations Interface
TA53 Advancements in Theory of Integer Programming
TA54 Network Problems in Embedded Graphs
TA55 Covering Problems and Applications
TA56 Methods for Large-Scale Nonlinear Optimization
TA57 Application of System Tools to Healthcare Engineering
TA58 Resource Allocation and Logistics Problems
TA59 Tutorial: New Sphere Methods for LP
TA60 Extensions and Applications of Linear and Cone Programming
TA61 Facility Location
TA62 Behavioral Studies on Individual Factors and Performance
TA63 Patient Scheduling
TA64 Teaching OR/MS
TA65 Panel Discussion: Challenges and Opportunities for Women in Academia
TA66 Operations with Financial Concerns
TA67 Stochastic Nonparametric Approaches to DEA
TA68 Sampling in Stochastic Optimization: Methodology and Application
TA69 PR Research Workshop
TA75 Joint Session-RAS/TSL: Recent Advances in Transportation Planning Systems

Tuesday, 11:00pm - 12:30pm

TB01 Portfolio Decision Analysis II
TB02 Information and Learning in Operations Management
TB03 Multi-Criteria Decision Making
TB04 Integration of Data Mining and Statistical Process Control
TB05 Panel Discussion: Quality Improvement in Nanomanufacturing
TB06 Recent Advances in Computer Experiments II
TB07 Quality and Reliability in Nanomanufacturing
TB08 Special Problems in Data Mining
TB09 Numerical Methods for Stochastic Controls
TB10 Queueing
TB11 Queueing Applications in Manufacturing and Maintenance
TB12 Network Flows
TB13 Panel: COIN-OR Technology Forum
TB14 Optimization in Practice IV - Software
TB15 Software Demonstrations
TB16 Personalization and Privacy
TB17 Applications of Two-sided Markets
TB18 Resiliency in Telecommunication Systems
TB19 Traffic Assignment Methods
TB20 Joint Session AAS/ TSL: Air Traffic Flow Management Models
TB21 Methods and Models for Road Pricing III
TB22 Risk Management in Supply Chains II
TB23 Applications of Optimization to Operations at the US Air Force Academy
TB24 OM Models of Strategic Customers
TB25 Joint Session AAS/TSL: Cost of Airline Delays, Cancellations, and Capacity Constraints
TB26 Stochastic Optimization I
TB27 Uncertainty Modeling and Simulation
TB28 Revenue Management in Online Advertising
TB29 Energy Model and Methods
TB30 Open Pit Mine Planning, I
TB31 Decentralized Revenue Management
TB32 Financial Engineering Methods and Applications
TB33 Pricing and Inventory Issues in Product Variety Management
TB34 Transportation and Environmental/Societal Impact
TB35 Scheduling and Resource Allocation Applications in Healthcare
TB36 Optimization in Radiotherapy III
TB37 Birthday Session for Warren Hausman and Bob Carlson
TB38 Topics in Inventory Management
TB39 Operations Models in Healthcare
TB40 Capacity Allocation Among Multiple Demand Classes
TB41 Service to Manufacturing
TB42 SCM for Make-to-Order Products
TB43 Managing Uncertainty in Supply Chains
TB44 Uncertainty Management in Services
TB45 Perspectives on Product Development Challenges
TB46 Vehicle Routing and Uncertainty
TB47 Teaching Service Supply Chain Management: Curriculum and Methods
TB48 Empirical Studies in Service Operations
TB49 Transportation and Coordination to Manage Supply Chain Disruptions
TB50 Managing and Structuring Services
TB51 Computational Integer Programming
TB52 Operations Management/Marketing Interface
TB53 Integer Programming and Computational Optimization
TB54 New Perspectives on Machine Learning
TB55 Generalized Assignment Problems
TB56 Advances in Nonlinear Programming Algorithms
TB57 Assessing Hospital Operations
TB58 Modern Problems in Scheduling
TB59 Tutorial: Logistics and Transportation in Global Supply Chains - Review
TB60 Applications of SDP to EDM and other Polynomial Optimization Problems
TB61 Logistics
TB62 Behavioral Research in New Product Development
TB63 Modeling and Optimization in Health Care
TB64 Business Analytics in the Business School
TB65 WORMS Keynote Session
TB66 Real Options in Operations Management
TB67 DEA in Banking and Investment
TB68 OR Practice in INFORMS Roundtable Companies
TB69 Single Machine Scheduling
TB75 Railroad Capacity Planning Session II

Tuesday, 12:30pm - 1:30pm

Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01 Risk in Portfolio Decision Analysis
TC02 Bayesian Simulation and Decision Analysis
TC03 Multiple Objective Optimization: Applications
TC04 Operations Research Methods for Data Mining
TC05 Panel Discussion: The Roles of Quality, Statistics and Reliability (QSR) in Energy-related Research Areas
TC06 Advances in Computer Experiments
TC07 Advanced Multivariate Data Analysis
TC08 Data Mining for Business Support
TC09 Joint Session AAP/MIF: Scheduling in Queueing Systems
TC10 Joint Session QSR/ HAS: Defining the Science of Quality in Health Care
TC11 Control and Design of Queueing Systems
TC12 Integer Programming and Applications
TC13 Computational Optimization for Logistics Applications
TC14 Optimization in Practice V - Modeling
TC15 Software Demonstrations
TC16 Joint Session IS/eBusiness: Internet Search and Advertising Auctions
TC17 The Impact of Social Networks, Contributor Incentives, and Proprietary Competitors on Open Source Development
TC18 Network Management and Design
TC19 Joint Session TSL/OR.MS: Dynamic Evacuation Planning and

Operations Models I
TC20 Joint Session TSL/OR.MS: Dynamic Evacuation Planning and Operations Models II
TC21 Warehouse Operations I
TC22 Risk Management in Supply Chains II
TC23 Modeling Human-Social-Cultural Terrain in the Operational Environment
TC25 Joint Session AAS/TSL: Optimization in Flight Scheduling
TC26 Edelman Finalists Reprise - III
TC27 Agent-based Modeling and Simulation: Overview and Mini-tutorial
TC28 Network/Cargo Revenue Management
TC29 Uncertainty, Renewables, Transmission and the New Zealand Electricity Market
TC30 Underground Mining Applications
TC31 Pricing and Choice-based Revenue Management Models in the Hospitality Industry
TC32 Finance
TC33 Economics Models in Supply Chains
TC34 Facility Location for Humanitarian Response
TC35 Empirical Research on Health Care Operations
TC36 Capacity Planning
TC37 Flowshop Scheduling
TC38 Inventory Management and Applications
TC39 Procurement and Supply Chain Management
TC40 Scheduling, Learning and Workforce Management in a Production Environment
TC41 Working with Non-profit Organizations
TC42 Sourcing in SCM
TC43 Managing Commodity Risk in Supply Chain
TC44 Advanced Modeling Methods for Health and other Services
TC45 New Product Development I
TC46 KLIC II
TC47 Outsourcing Governance, Capabilities, and Outcomes
TC48 Advances in Teaching Service & Retail Operations
TC49 Supply Chain Decisions to Manage Disruptions
TC50 Managing Service Systems: Some Insights on Scheduling, Capacity Planning and Pricing
TC51 Computational Linear and Integer Programming
TC52 Supply Chain Competition and Coordination
TC53 New Integer Programming Applications
TC54 Computing Equilibrium in Markets and Games
TC55 Traveling Salesman Problems
TC56 Algorithms and Applications of Polynomial Optimization and Robust Optimization
TC57 Scheduling of Patients/Physicians in Clinics
TC58 Cyclic Scheduling and Robotic/Cluster Tools
TC59 Tutorial: Assessing Solution Quality in Stochastic Programs via Sampling
TC60 Semidefinite Programming: Algorithms and Applications
TC61 Logistics/Warehousing
TC62 Behavioral Operations Management
TC63 Resource Allocation in Health Care
TC64 Education I
TC65 Inventory Management During Transition
TC66 Production and Hedging in Supply Chains
TC67 Data Envelopment Analysis: Methods and Applications
TC68 Stochastic Programming Models in Supply Chain Management
TC69 Environmental Operations I

Tuesday, 4:30pm - 6:00pm

TD01 Portfolio Decision Analysis Panel Discussion
TD02 Decision Analysis Arcade I
TD03 Multi-objective Problems in Medicine
TD04 Data Mining Applications
TD05 Joint Session QSR/ HAS: Defining the Science of Quality in Public Health
TD06 Prognostics/Health Management, Sensors, and RFID I
TD07 Design and Analysis of Experiments in Modern-day Science and Technology
TD08 Data Mining Contest
TD09 Scheduling Issues in Computer Systems
TD10 Stochastic Inventory and Related Models
TD11 Queueing Models-Session
TD12 Locational Analysis and Computing
TD13 Optimization in Practice VI - Health Care
TD14 Genome Variation Analysis
TD15 Software Demonstrations
TD16 Contracts and Sourcing
TD17 Security Challenges in e-Business Environment
TD18 Wireless Networks I
TD19 Tutorial: Warehouse Design and Open Research Issues
TD20 Supply Chain Design
TD21 Emerging Areas: Transportation and Biofuels
TD22 Air Traffic Management
TD23 Simulation of Military Systems
TD25 Optimization Models in Air Traffic Flow Management
TD26 Risk Management in Cost Estimation
TD27 Simulation Optimization I
TD28 Non-parametric Data-Driven Methods in Revenue Management
TD29 Options Pricing in Energy Market
TD30 Energy I
TD31 Pricing Under Uncertainty
TD32 Option Pricing and Applications
TD33 Supply Chain Management
TD34 Joint Session OR.MS/TSL: Logistics and Response in Large-Scale Disaster
TD35 Stochastic Programming and Cost Effectiveness Applications in Health Care
TD36 Health Care Access
TD37 Empirical Research on Supply Chain Management
TD38 Data Driven Algorithms for Stochastic Inventory Control
TD39 Strategic and Tactical Procurement in Supply Chain
TD40 Pricing Problems in Operations Management
TD41 Energy, Environment, and Sustainability
TD42 Supply Chain Coordination I
TD43 Managing Commodity Risk in Supply Chain
TD44 Models of Service Management
TD45 Organization Theory I
TD46 Modularity in Services: Efficiency, Flexibility, and Innovativeness
TD47 Globalization of Services
TD48 Decision Making and Process Improvement in Complex Service Organizations
TD49 Performance and Configurations of Production/Supply Systems for Multi-product Production Interruption Management
TD50 Managing Customers and Partners in Services
TD51 Methods for Optimization Problems in Networks
TD52 Marketing and Operations Strategies in the Retail Industry
TD53 Recent Results in Discrete Optimization
TD54 Geometric Methods in Algorithms and Optimization
TD55 Computer Science-OR Applications to CS
TD56 Algorithms and Applications for Compressed Sensing
TD57 RFID/Sensor Data in Healthcare Operations
TD58 OutSourcing and Subcontracting Games
TD59 Tutorial: Fractional Programming with Applications
TD60 Multivariate Polynomial Optimization: Theory and Algorithms
TD61 Humanitarian Logistics
TD62 Teamwork and Communication
TD63 Process Analysis in Health Care I
TD64 Education II
TD65 Joint Session wORms/JFIG: Panel Discussion: What I Wish I Had Known: PhD Years and Beyond
TD66 Financial Engineering Models and Applications
TD67 Data Envelopment Analysis: Methodology
TD68 Sampling and Scenarios in Stochastic Programming

TD69 Forecasting

Wednesday, 8:00am - 9:30am

WA01 DA in Oil & Gas I
WA02 Facilitated Decision Analysis
WA03 Interactive Multiple Criteria Decision Making
WA04 Mathematical Programming in Pattern Recognition and Machine Learning
WA05 High Definition Metrology Based Manufacturing Process Control
WA06 Acceptance Sampling and Control Charts
WA07 Condition Based Maintenance
WA08 Nonparametric Statistics and Applied Data Mining
WA09 Decision and Learning for Stochastic Systems
WA10 Economic Risk Analysis
WA11 Tail Asymptotics in Queues
WA12 Computational Linear Programming
WA13 Large Scale Computational Optimization Theory and Applications
WA14 Optimization Software at Sandia National Laboratories: PEBBL, PICO, and Related Tools
WA15 Software Demonstrations
WA16 Joint Session Information Systems/Data Mining: Social Data Mining
WA17 Digital Social Networks
WA18 Wireless Networks 2
WA19 Freight Transportation Network Design
WA20 Freight Planning & Policy
WA21 Order Picking
WA22 Managing Delays in Aviation
WA23 Modeling, Operations Research, and Decision Making I
WA25 Joint Session AAS/TSL: Air Traffic Management Performance Analysis
WA26 Globalization and Global Manufacturing
WA27 Advances in Simulation I
WA28 Optimal Pricing
WA29 Decision Making in Electricity Markets
WA30 Energy II
WA31 Pricing & Revenue Management: A Marketing Perspective
WA32 Credit Risk Analysis
WA33 Design and Management of Global Supply Chains
WA34 "What Can a Model Do for Me?" Practical Public Health and Humanitarian Applications of OR
WA35 Models for Hospital Scheduling and Resource Management
WA36 Stochastic Models in Health Care
WA37 Procurement and Supply Chain Management
WA38 Online Learning with Applications to Supply Chain and Revenue Management
WA39 New Models in Spare Parts Management
WA40 Materials Coordination in Multi-Location Inventory Systems
WA41 Operations Research Applications for Elections
WA42 Supply Chain Coordination II
WA43 Operational and Contractual Decisions in Inventory and Supply Chain Models
WA44 Joint-Production Service Operations
WA45 New Product Development II
WA46 Technology Licensing and Creativity
WA47 Outsourcing
WA48 Panel Discussion: Future OM Research Possibilities Within Health Care
WA49 Strategic Models for Mitigating Supply Chain Disruptions
WA50 Service Quality and Congestion
WA51 Computational Stochastic Mixed-Integer Programming
WA52 Competition and Innovation in Supply Chains
WA53 Topics in Integer Programming
WA54 Sublinear Time Algorithms
WA55 Inventory Routing Problems
WA56 Dynamic Pricing in Revenue Management
WA57 Informing Health Policy through Operations Research
WA58 Crew Scheduling
WA59 Tutorial: Lean Six Sigma in Services
WA60 Convex Optimization
WA61 Heuristic Programming
WA62 Behavioral Operations
WA63 Process Analysis in Health Care II
WA64 Education III
WA65 Inventory Models for Deteriorating Items
WA66 Commodity Trading and Procurement
WA67 Strategic Forecasting and Optimization
WA68 Algorithms and Computations in Stochastic Programming
WA69 Operations Management
WA70 Green Supply Chain Management
WA71 Supplier Selection
WA72 Artificial Intelligence/Neural Networks
WA73 Analysis of Queueing Models I
WA74 Life Testing in Reliability

Wednesday, 11:00am - 12:30pm

WB01 DA in Oil & Gas II
WB02 Panel Discussion: Lessons Learned from using Experts in DA/RA Studies
WB03 Multiobjective Optimization: Methods and Applications
WB05 Operations and Management in Energy Industry II
WB06 Prognostics/Health Management, Sensors, and RFID II
WB07 System Informatics and Control
WB08 Special Topics in Data Mining
WB09 Scheduling: Performance and Optimization
WB10 Risk Analysis
WB11 Data Mining in Health Care and Biology
WB12 Applications to OR
WB13 CP Technology
WB14 New Algorithms for Convex Cone Programming
WB15 Software Demonstrations
WB16 Joint Session IS/eBusiness: E-commerce Strategy and Mechanism Design
WB17 E-Business/Commerce I
WB18 Optimization in Practice VII - RAMP
WB19 Traffic Management I
WB20 Collaboration and Competition in Freight Transportation
WB21 Automation and Material Handling
WB22 Models for Fractional Airlines
WB23 Modeling, Operations Research, and Decision Making II
WB24 Missile Defense
WB25 Air Traffic Management I
WB26 Data Envelopment Analysis I
WB27 Simulation Optimization II
WB28 Distribution Channels
WB29 Green Energy III
WB30 Energy III
WB31 Estimation of Revenue Management Impact in Airlines and Internet
WB32 Finance and Risk Management I
WB33 Operations/Finance Interface
WB34 Joint Session OR.MS/TSL: Evacuation
WB35 Dynamic Programming and Optimal Control Applications in Medical Decision Making
WB36 Modeling for Public Health Emergency Preparedness
WB37 Practice and Empirics
WB38 Recent Topics in Inventory Management
WB39 Performance Management in Stochastic Inventory Settings
WB40 Logistics and Information Systems
WB41 Joint Session SPPSN/ MIF: Treating Emergency Medical Patients
WB42 Supply Chain Management I
WB43 Approximate Dynamic Programming for Supply Chains
WB44 Development of Product-Service Systems
WB45 Management of Technology
WB46 Technology, QFD and Logistics Services
WB47 Marketing I
WB48 Advances in Appointment Scheduling under Uncertainty

WB49 Design and Analysis of Distribution Supply Chains
WB50 Lot Sizing I
WB51 Engineering Applications of Stochastic Programming
WB52 New Topics on OM/Marketing Interface
WB53 Joint Session Optimization/Minority Issues: Branchwidth, Treewidth, and Integer Programming! Oh, my!!
WB54 Approximation Algorithms
WB55 Vehicle Routing I
WB56 Pricing and Revenue Management I
WB57 OR Applications in Healthcare
WB58 Scheduling for Computing and Service Systems
WB59 Tutorial: Open-Source Software
WB60 Optimization Techniques
WB61 Emergency System Design
WB62 Career Issues in Organizations
WB63 Health Care Strategy I
WB64 Industry Applications
WB65 Multi-Echelon Inventory Management
WB66 Integrating Performance Management of Operational Risk in Core Planning Processes: Recent Activity at Leading Companies
WB67 Robust and Adaptive Optimization
WB68 Chance-constrained Stochastic Programming
WB69 Social Networks and Peer Effects Session
WB70 Supply Chain Facility Design
WB71 Supply Chain Optimization
WB72 Novel Applications
WB73 Analysis of Queueing Models II
WB74 Reliability

Wednesday, 12:45pm - 2:15pm

WC01 Joint Session DA/ ENRE: Expert Elicitations and Analysis on Energy Technology
WC02 Preferences Over Intertemporal Outcomes
WC03 Mitigation Strategies for Supply Chain Disruptions
WC04 Data Mining for Prediction Problems
WC05 Discussion Session: Recent Progress in Variation Reduction Methodologies for Manufacturing Processes
WC06 Advances in Control Charting Methods
WC07 Joint Session QSR/ HAS: Simulating Quality in Health Care
WC08 Data Mining Approaches for Biomedical Problems
WC09 Control of Queues
WC10 Heuristics for Assignment Problems
WC11 Data Mining
WC12 Modeling Systems and Languages
WC13 Data Mapping Frameworks for Interfacing Modeling System Data to Other Tools
WC14 Hybrid Optimization
WC15 Hidden Linearity, Hidden Convexity, and Hidden Separability in General Nonlinear Programming — Uncovered, Reformulated, and then Transformed for Both Qualitative and Quantitative Exploitation II
WC16 Search Engine Marketing
WC17 E-Business/Commerce II
WC18 Network Design and Routing
WC19 Traffic Management II
WC20 Maritime Inventory Routing
WC21 Flow Allocation in Transportation
WC22 Models in Transportation Safety
WC23 OR Military Modeling Support Applications
WC24 Interdiction Models
WC25 Lot Sizing II
WC26 Data Envelopment Analysis II
WC27 Advances in Simulation II
WC28 Inventory Cost Optimization
WC29 Networks and Pricing
WC30 Investment Decisions in Energy Sector
WC31 Revenue Management and Dynamic Pricing
WC32 Finance and Risk Management II
WC34 Transportation and Humanitarian/Societal Impact
WC35 OR and OM Modeling in Health Care
WC36 Optimization in Radiotherapy IV
WC37 Transportation in SCM
WC38 Optimal Production and Inventory Planning
WC39 Advance Selling and Strategic Consumer Behavior
WC40 Retail Operations
WC41 Modeling Mass Egress and Evacuations
WC42 Supply Chain Management II
WC43 Supply Chain Contract Design under Asymmetric Information
WC44 Services Factory Modeling
WC45 Innovation Management under Collaboration
WC46 Design and Brand Management
WC47 Marketing II
WC48 Managing Service Variability
WC49 Resource Constrained Project Scheduling
WC50 Fairness in Service Systems
WC51 Decomposition Methods for Integer Programming I
WC52 Economic Models in Supply Chains
WC53 Advances in Integer Programming
WC54 Network Design and Algorithms
WC55 Vehicle Routing II
WC56 Pricing and Revenue Management II
WC57 Game Theoretic Applications in Healthcare II
WC58 Scheduling and Timetabling
WC59 Tutorial: Recent Advances in Nonlinear Programming
WC60 Stochastic Optimization II
WC61 Evacuation Planning
WC62 Organization Theory II
WC63 Health Care Strategy II
WC64 Internet Applications
WC65 Multi-Item Inventory Management I
WC66 Network Optimization I
WC67 Algorithmic Developments in Stochastic Optimization I
WC68 Optimization with Stochastic Dominance Constraints
WC69 TV and Online Advertising
WC71 Remanufacturing in Inventory Management
WC72 Nanotechnology
WC73 Optimal Control of Queues I
WC74 Dynamic Programming Applications

Wednesday, 2:45pm - 4:15pm

WD01 Decision Analysis and Support Systems
WD02 Decision Analysis Arcade II
WD03 Game Theory
WD04 Recommender Systems
WD05 Joint Session QSR/Data Mining: Data Mining for Process Monitoring
WD06 Panel Discussion Session: Challenges and Opportunities in Nanomanufacturing Process Modeling and Control
WD07 Joint Session QSR/ HAS: Impact of Schedule Modeling on Quality
WD08 Adaptive Modeling in Multi-Stage Decision-Making
WD09 Statistics, Approximations and Monte Carlo Methods with Applications to Queues and Large Parallel Systems
WD10 Metaheuristics I
WD12 Optimization Software Frameworks
WD14 Heuristics in Logistics and Transportation
WD15 Hidden Linearity, Hidden Convexity, and Hidden Separability in General Nonlinear Programming — Uncovered, Reformulated, and then Transformed for Both Qualitative and Quantitative Exploitation III
WD16 Web Services
WD17 Information Systems and Business Processes
WD18 Optimization in Practice VIII - Scheduling
WD19 Freight Transportation
WD20 Queuing Models in Air Traffic Management
WD21 Facility Logistics: Facility Design

WD22 Network Design in Transportation
WD23 Operations Research at the Joint IED Defeat Organization
WD25 OR at AD OPT
WD27 Simulation and Optimization
WD29 Risk Management
WD30 Planning and Scheduling in Energy
WD31 Applications in Revenue Management
WD32 Portfolio Analysis I
WD34 Environmental Operations II
WD35 Modeling and Analysis in Healthcare Systems
WD36 Operations Research in Preventive Healthcare and Public Policy
WD38 Inventory Management using Advance Supply Information
WD39 Operations Economics
WD40 Supply Chain Management: Innovative Production Systems and Asymmetric Information
WD41 OR and Litigation Support
WD42 Supply Chain Management III
WD43 Dual Channel Strategies in SCM
WD44 Service Resource Management: Theory and Application
WD45 Innovation Management
WD46 Student Paper Session: MOTI
WD47 Marketing III
WD48 Innovations in Healthcare Service Operations
WD49 OR Models for Workforce Management
WD50 Production and Scheduling I
WD51 Decomposition Methods for Integer Programming II
WD52 Pricing, Contracts and Channel Structure
WD53 Integer Programming Applications
WD54 Compressed Sensing: Theory and Applications
WD55 Auctions and Mechanism Design
WD56 Revenue Management
WD58 Parallel Machine Scheduling
WD59 Business Analytics & Other Topics
WD60 Stochastic Optimization III
WD63 Health Care Strategy III
WD65 Multi-Item Inventory Management II
WD66 Networks and Graphs
WD67 Stochastic Programming and Applications
WD68 SP in Finance
WD69 Issues in Revenue Management
WD71 Remanufacturing in SCM
WD73 Optimal Control of Queues II
WD74 Markov Decision Processes/Optimal Control

Wednesday, 4:30pm - 6:00pm

WE02 Decision Analysis II
WE03 Game Theory Applications
WE05 Quality Management I
WE06 New Implementations of System Reliability Design & Optimization
WE07 Discussion Session: Strategic Research Directions in Quality, Statistics, and Reliability
WE09 Applied Probability
WE10 Metaheuristics II
WE18 Optimization in Practice IX - Education
WE19 Hazmat Transportation
WE20 Intelligent Systems in Transportation
WE29 Product Design for Sustainability
WE30 Pricing in Energy Markets
WE32 Portfolio Analysis II
WE37 MSOM/Supply Chain Management
WE39 Applications of Cooperative Game Theory in Supply Chain Analysis
WE40 Behavioral Research in Operations and Supply Chain Management
WE41 Detection and Deterrence
WE42 Topics in SCM
WE43 Information Sharing in SCM
WE44 Retail Management
WE45 Contracts in Supply Chain Management
WE46 Technology Management
WE47 Pricing in Telecommunications
WE50 Production and Scheduling II
WE51 Threat Detection for Homeland Security
WE52 Forecasting and Simulation Models
WE53 Knapsack Problems and Applications
WE54 Compressed Sensing: Theory and Applications
WE55 Auctions
WE56 Pricing Digital Goods
WE57 Quality Management II
WE60 Robust Optimization
WE63 Therapy and Treatment Models in Health Care
WE66 Network Optimization II
WE68 Algorithmic Developments in Stochastic Optimization II
WE73 Managing Disruptions in Supply Chains
WE74 Risk Modeling in Energy Markets

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A mandate for change is a mandate for smart.

Our political leaders are not the only ones who have been handed a mandate for change. Operations researchers and leaders of businesses and institutions everywhere have a unique opportunity to transform the way the world works.

The problems of global climate change and energy, global supply chains for food and medicine, new security concerns ranging from identity theft to terrorism – all issues of a hyperconnected world –
have surfaced since the start of this decade.

The world continues to get "smaller" and "flatter." But we see now that being connected isn't enough. Fortunately, something else is happening that holds new potential: the planet is becoming smarter.

That is, intelligence is being infused into the way the world literally works – into the systems, processes and infrastructure that enable physical goods to be developed, manufactured, bought and sold. That allow services to be delivered. That facilitate the movement of everything from money and oil to water and electrons. And that help billions of people work and live.

Consider. Congested roadways in the U.S. cost $78 billion in 4.2 billion lost work hours and 2.9 billion gallons of wasted gas annually – and that's not counting the impact on air quality. Inefficient supply chains cost $40 billion annually in lost productivity – more than 3% of total sales.

And, of course, we've seen what's developed in our financial markets, a system in which institutions could spread risk, but not track it.

Yet all of these things are solvable on a smarter planet.

Stockholm has used smart traffic systems to cut gridlock by 20%, reduce emissions by 12% and increase public transportation use dramatically.

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