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Spring 2000

Salt Lake City

May 7-10, 2000

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Copies of papers abstracted in the Conference Program are available only from the authors. Requests for papers should be directed to the authors at the addresses shown in the Program. Published twice a year prior to each meeting by the Institute for Operations Research and the Management Sciences. Individual issues of the Program are available for \$15US (INFORMS member) and \$25US (nonmember) per copy. Orders must be prepaid and sent to INFORMS, PO Box 64794, Baltimore, MD 21264-4794.

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It's going to be one hot summer at Irwin/McGraw-Hill.

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May, 2000

Greetings!

As Mayor of Salt Lake City, and on behalf of our residents, it is my pleasure to welcome the Institute for Operations Research and The Management Sciences Conference. We are delighted you have chosen our beautiful city to host your meeting.

Salt Lake City is a very progressive and enjoyable community. It is a cosmopolitan city with a variety of convention facilities, first-class accommodations, and many entertainment and recreational opportunities. We invite you to take time out of your busy schedule to sample our many fine restaurants, as well as our historic, cultural and artistic attractions.

From the beauty of our mountains to the friendliness of our people, we are confident you will have an enjoyable and memorable visit. Best wishes for a productive and successful conference.

Again, welcome to Salt Lake City.

Sincerely,



Ross C. Anderson

Mayor



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OFFICE OF THE GOVERNOR
SALT LAKE CITY
84114-0601

MICHAEL O. LEAVITT
GOVERNOR

OLENE S. WALKER
LIEUTENANT GOVERNOR

May, 2000

Dear Friends:

As Governor, it gives me great pleasure to extend my warmest greetings and welcome all of you to Salt Lake for the 2000 INFORMS Conference and Exhibition.

The natural scenic beauty, recreational opportunities, and historic attractions of Utah are assets to be enjoyed by all visitors. Salt Lake City is literally the crossroads of the West, and the center of a dynamic and flourishing state and region.

Your participants will also find Utah a friendly state filled with exciting and interesting things to see and do. Utah has world class ski resorts, unlimited sightseeing in five national parks, and extensive recreational activities from water sports to mountain hiking.

Utah is proud of the record we have established as a proven host for many national and regional conventions. We look forward to providing your organization a pleasant and profitable convention in Salt Lake City, Utah.

Sincerely,

Michael O. Leavitt
Governor

Message from the General Chair
William C. Giauque
Brigham Young University

We, the organizing committee of the INFORMS Spring 2000 meeting in Salt Lake City, welcome you to our city. Salt Lake is one of the less well-known treasures of the country, and we hope that you will take some time to get to know the city and the surrounding areas, as well as participating in the professional program that forms the heart of the conference.

This meeting is a time to both reflect on the past half-century of accomplishment for our profession, and to look ahead at the substantial promises made possible by theoretical, practical and technical advances in management sciences. Our three plenary speakers all address these themes. Gene Woolsey, who will be speaking from 1:00 to 2:00 on Monday, will discuss in his own inimitable fashion the lessons learned from 29 years of teaching at the Colorado School of Mines. All students at Mines are required to complete one or more projects leading to results that are actually used and save the clients money – so far in excess of \$250 million. Tom Magnanti, our keynote speaker, will discuss the unprecedented opportunities for research and educational innovation created by new information and communication technologies. Based on recent experiences at MIT, Professor Magnanti will outline opportunities in such fields as supply chain management, e-commerce, bio-instrumentation and product design. His address will be on Tuesday from 8:30 to 10:00. The meeting will also feature Edward H. Kaplan as the Omega Rho Distinguished Lecturer. Professor Kaplan will discuss applications of policy modeling in HIV prevention, an obviously critical application of applied quantitative evaluation. The Omega Rho lecture will be on Sunday evening from 5:00 to 6:00. Our third plenary speaker is Robert W. Mendelhall, President and CEO of Western Governors University. He will discuss the historical development, current status and future direction of the university on Tuesday morning from 10:30 to 11:30.

The technical program will feature tracks in several technical areas, including decision analysis and decision support systems, scheduling, manufacturing, supply chain management, inventory management, planning, math programming, evolutionary algorithms, military applications and several other areas. We have two special features, a program honoring Seth Bonder and his work on Tuesday afternoon and a series of sessions on simulation techniques and technology, chaired by Charles Harrell, also on Tuesday afternoon. In addition there are several tutorials on simulation associated with this session, as well as other tutorials of interest to INFORMS professionals.

Salt Lake City is a beautiful, interesting place to visit. Several noteworthy places to visit are within walking distance of the Salt Palace. Particularly noteworthy are Temple Square and associated visitor's centers and gardens, the Utah State Capitol visible on a hill to the north, the Joseph Smith Memorial Building (the former Hotel Utah) just to the east of Temple Square and Maurice Abravanel Concert Hall just to the north of the Salt Palace. A short drive or bus ride will take you to the Old Deseret Pioneer Village and This Is The Place State Park, Hogle Zoo, the Kennecott Copper Mine or any of several museums. If you would like to take a half-day or longer trip, the surrounding mountains and canyons offer spectacular scenery. We particularly recommend Park City to the east or any of the many ski resorts in the area.

I would like to sincerely thank those who worked to bring this meeting about. Those deserving special thanks are members of the Salt Lake City Committee, several members of the INFORMS Meetings Committee who generously gave of their time and efforts and Julie Eldridge and Ginni McGee from the INFORMS staff who did most of the critical management and administrative work.

Again, welcome to Salt Lake City. Please feel free to contact any of the members of the local committee during your stay if we can help.

Special Events Schedule

Friday, May 5

	Location	From	To
Second Teaching Effectiveness Colloquium	Parlays 1 & 2 (W)	6:00p	10:00p

Saturday, May 6

Edelman Rehearsal	Wasatch 1 & 2 (W)	9:00a	6:00p
Second Teaching Effectiveness Colloquium	Wasatch 3 (W)	8:00a	6:00p
Meetings Committee Meeting	Suite 1531(M)	8:30a	5:00p
Second Teaching Effectiveness Colloquium Lunch	Cottonwood 1 & 2 (W)	12noon	1:00p
INFORMS Board Executive Committee Meeting	Solitude (M)	12noon	4:00p
General Member Meeting & Reception	Room 250 A-C (S)	5:00p	6:00p

Sunday, May 7

Conference Registration	Outside Ballroom, Lower Level (S)	7:30a	5:00p
Second Teaching Effectiveness Colloquium	Wasatch 3 (W)	8:00a	12noon
Wolfram Workshop	Salon B (M)	8:00a	12noon
INFORMS Board Meeting/Lunch	Salon G & H (M)	8:00a	5:00p
Franz Edelman Award Competition	Wasatch 1 & 2 (W)	8:00a	5:00p
IEEE Meeting	Snowbird	8:00a	5:00p
INFORMS Online Meeting	Brighton (M)	10:00a	12noon
Section/Society Subcommittee Meeting	Cottonwood (M)	12noon	1:00p
Job Fair	Ballroom, Lower Level (S)	12noon	2:00p
Exhibit Hall, E-Mail Center & Job Placement	Ballroom, Lower Level (S)	12noon	5:00p
Subdivision Committee Meeting	Salon C (M)	11:30a	2:00p
Nicholson Student Paper Prize Competition I & II	Room 150D (S)	1:00p	4:30p
RASIG Roundtable	Wasatch 3 (W)	1:00p	5:00p
IFORS 2002 Meeting	Solitude (M)	4:00p	5:30p
Omega Rho Distinguished Lecture - E. H. Kaplan	Room 250 (S)	5:00p	6:00p
Subdivision Nominating Assembly	Salon C (M)	5:00p	6:00p
MAS Council	Suite 1531 (M)	5:00p	7:30p
Aviation Applications/RASIG/TSS Reception	Room 256A (S)	6:00p	7:30p
Roundtable Reception/Dinner	Salon A (M)	6:00p	8:00p
MSOM Reception	Room 251F (S)	6:15p	7:30p
DAS Council Meeting	TBD	6:30p	9:30p
Forum on Women in OR/MS Reception	Parlays 1 & 2 (W)	7:00p	9:00p
Student Reception	Salon E & F (M)	7:00p	9:00p
Roundtable Meeting	Salon I & J (M)	8:00p	11:00p

Monday, May 8

Board/Editors/Committee Chair Breakfast	Salon A & B (M)	7:00a	8:00a
Roundtable Meeting & Lunch	Salon I & J (M)	7:00a	5:00p
Teacher Program	Wasatch 2 (W)	8:00a	3:00p
Conference Registration	Outside Ballroom, Lower Level (S)	8:00a	5:00p
INFORMS Board Meeting	Salon G & H (M)	8:00a	2:00p
Welcome & Awards Session	Room 250 (S)	8:30a	10:00a
Guest Breakfast	Brighton (M)	9:00a	10:00a
Exhibit Hall, E-Mail Center & Job Placement	Ballroom, Lower Level (S)	9:00a	5:00p
Franz Edelman Award Luncheon	Wasatch 4 (W)	12noon	1:00p
Section Subcommittee Luncheon	Red Butte (W)	12noon	1:00p
ACORD Luncheon	Cottonwood 1 (W)	12noon	1:00p
OR Area Editors Luncheon	Parlays 2 (W)	12noon	1:00p
Omega Rho Meeting	Cedar (W)	12noon	1:00p
Education Committee Meeting	Parlays 1 (W)	12:30p	1:30p
INFORMS Invited Plenary - R. E. Woolsey	Room 250 (S)	1:00p	2:00p
Section/Society/Fora Officers Meeting	Cottonwood 1 (W)	5:15p	6:15p
CPMS Isolated Practitioners Workshop	Room 254C (S)	5:45p	6:45p
IOL Reception	Solitude (M)	6:00p	7:30p
JOC Editors Meeting	Room 251A (S)	6:45p	7:45p
General Reception	Grand Ballroom (M)	7:30p	9:30p

Tuesday, May 9

Chapters & Student Chapters Breakfast	Parlays 1 (W)	7:00a	8:00p
Student Chapters Subcommittee Meeting	Parlays 2 (W)	8:00a	9:30a
Chapter Subcommittee Meeting	Parlays 1 (W)	8:00a	9:30a
CPMS Congress on Practice	Wasatch 3 (W)	8:00a	10:00a
Finance Committee Meeting	Snowbird (M)	8:00a	10:00a
Conference Registration	Outside Ballroom, Lower Level (S)	8:00a	5:00p
Meetings Committee Meeting	Suite 1531 (M)	8:00a	6:00p
Second IFORS Distinguished Lecture - T. Magnanti	Room 151G (S)	8:30a	10:00a
Guest Breakfast	Brighton (M)	9:00a	10:00a
Exhibit Hall, E-Mail Center & Job Placement	Ballroom, Lower Level (S)	9:00a	5:00p
CPMS Council Meeting	Wasatch 3 (W)	10:00a	12noon
INFORMS Invited Plenary: R. W. Mendenhall	Room 250 (S)	10:30a	11:30a
Subdivision Committee Meeting	Cottonwood 2 (W)	11:30a	5:00p
MAS Session Honoring Dr. Seth Bonder	Room 253B (S)	2:45p	4:15p

Wednesday, May 10

Conference Registration	Outside Ballroom, Lower Level (S)	8:00a	10:30a
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Subdivision Business Meetings**Sunday, May 7**

Railroad Applications SIG	Wasatch 3 (W)	5:00p	6:00p
Section on Location Analysis	Room 258 (S)	6:15p	7:15p
Section on Logistics	Room 257 (S)	6:15p	7:15p
Section on Management Control Systems	Room 252B (S)	6:15p	7:15p
Quality, Statistics & Reliability Section	Room 150G (S)	6:15p	7:15p
Revenue Management Section	Room 252A (S)	6:15p	7:15p
College on Simulation	Room 255C (S)	6:15p	7:15p
Technical Section on Telecommunications	Room 151C (S)	6:15p	7:15p

Monday, May 8

Forum on Women in OR/MS	Room 252B (S)	12noon	1:00p
Applied Probability Society	Room 254B (S)	5:45p	6:45p
Section on Aviation Applications	Room 256B (S)	5:45p	6:45p
Computing Society	Room 251B (S)	5:45p	6:45p
Decision Analysis Society	Room 251D (S)	5:45p	6:45p
Financial Services Section	Room 252A (S)	5:45p	6:45p
Section on Group Decision & Negotiation	Room 253B (S)	5:45p	6:45p
Section on Mgmt. of Productivity & Technology	Room 254A (S)	5:45p	6:45p
College on Marketing	Room 150D (S)	5:45p	6:45p
MSOM	Room 251F (S)	5:45p	6:45p
Military Applications Society	Room 253A (S)	5:45p	6:45p
College on Organization Science	Room 150E (S)	5:45p	6:45p
Technology Management Section	Room 254A (S)	5:45p	6:45p
Transportation Science Section	Room 256A (S)	5:45p	6:45p

Tuesday, May 9

Section on Auditing, Accounting & Tax	Room 151E (S)	6:15p	7:15p
College on Artificial Intelligence	Room 151D (S)	6:15p	7:15p
INFORM-ED Education Forum	Room 254A (S)	6:15p	7:15p
Energy, Natural Resources & the Environment	Room 151C (S)	6:15p	7:15p
College on Optimization	Room 255B (S)	6:15p	7:15p
Section on Public Programs & Processes	Room 151F (S)	6:15p	7:15p

M = Marriott Downtown**S = Salt Palace Convention Center****W = Wyndham Hotel**

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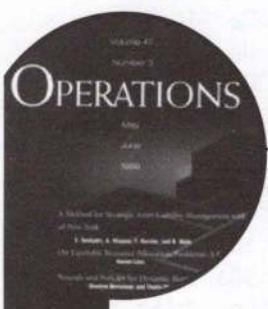
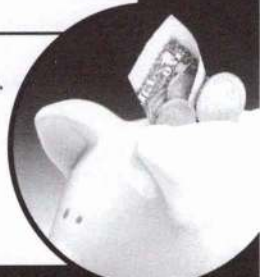
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Basic Information

Audio/Visual: An overhead projector and screen will be provided in every session room. Use simple transparencies with large print and bring blank transparencies for revisions and answers to questions. Arrangements for all other A/V equipment must be made in advance at the speaker's expense. **ON-SITE LCD REQUESTS WILL NOT BE HONORED.**

Book & Literature Display: Be sure not to miss the book and literature display located in the Exhibit Hall. Stop by for the opportunity to see the most recent publications from Baltzer Science Publishers, The Darden Case Collection, Gordon & Breach Science Publishers and Nature Publishing Group.

Business Meetings & Technical Sessions: All technical sessions will be located in the Salt Palace Convention Center. Room assignments will be listed in the final printed program only. Many of the subdivision business meetings will be in the Salt Palace Convention Center but not all of them. Please refer to the schedule of Subdivision Meetings.

Coffee Breaks: All breaks in will be held in the Salt Palace Convention Center:

Sunday - Exhibit Hall
2:30 - 3:00p

Monday - Exhibit Hall
10:00 - 10:30a & 2:00 - 2:15p

Tuesday - Exhibit Hall
10:00a -10:30a & 2:30 - 2:45p

Wednesday - Registration Area
10:00 - 10:15a

E-Mail Center: Meeting attendees can use e-mail in the Exhibit Hall on the Lower Level of the Salt Palace Convention Center. Name badges must be worn for admittance to the Exhibit Hall. The e-mail center will be open during the following hours:

Exhibitors

This year's exhibitors at the INFORMS Salt Lake City meeting offer a wide variety of the latest software developments, the newest releases in educational texts and the most sophisticated tools for OR and MS practitioners. The Exhibit Hall is located in the Ballroom on the Lower Level of the Salt Palace Convention Center, Sunday through Tuesday.

Sunday, May 7	12noon 5:00p
Monday, May 8	9:00a 5:00p
Tuesday, May 9	9:00a 5:00p

Exhibit Hall: Exhibits will be in the Ballroom on the Lower Level of the Salt Palace Convention Center. Name badges must be worn for admittance - the hall will be open during the following hours:

Sunday, May 7	12noon 5:00p
Monday, May 8	9:00a 5:00p
Tuesday, May 9	9:00a 5:00p

Hotel Accommodations: Sleeping rooms have been booked at 3 hotels: the Marriott Downtown, the Shilo Inn and the Wyndham Hotel.

INFORMS Online: The preliminary program is available online ONLY and will be updated regularly until the meeting. This allows us the flexibility of a longer time frame to accept papers and to continuously add to the program. Go to www.informs.org/Conf/SaltLake2000/, highlight sessions of interest to you and print your own customized program. Contact authors directly at their addresses as listed online to receive complete copies of any papers abstracted in the program.

Once the preliminary program is finalized and published on the Web, we can continue to add to existing sessions and create new sessions where space allows. We cannot move individual presentations or entire sessions to a different time within the same day or to different days. The final version of the program is sent to the printer several weeks before the meeting to allow time for printing and shipping to the meeting site. Additions, changes and withdrawals received after the final program is printed are listed in the addendum. The program on the Web is updated regularly.

INFORMS Salt Lake City

Applied Decision Analysis LLC, 2710 Sand Hill Rd., Menlo Park, CA 94025; www.adainc.com

Booth 25

ADA is a member of the PricewaterhouseCoopers organization. PricewaterhouseCoopers, the world's largest professional services organization, helps its clients build value, manage risk and improve their performance. ADA publishes DPL, decision analysis software for Windows. DPL integrates influence diagrams, decision trees, spreadsheets and strategy tables for professional decision analysis modeling.

ALPHATECH, Inc., 50 Mall Rd., Burlington, MA 01803-4562; www.alphatech.com

Booth 20

ALPHA/Sim is a general-purpose, discrete-event simulation tool based on Petri nets. The graphical modeling environment provides a simple yet powerful set of model building blocks making it easy to learn and use productively. Single-user, site and educational licensing available. Platforms include PCs (NT) and Sun Workstations (SunOS or Solaris). ALPHATECH offers training, consulting and technical support.

AutoSimulations Inc., 655 Medical Dr., Bountiful, UT 84010; www.autosim.com

Booth 24

AutoSimulations develops, markets and supports simulation and scheduling software products for the manufacturing and material handling industries. The new release of AutoMod 9.0 offers a Model Communications Module: users can transfer model data among multiple models or with external applications through Windows sockets. 3-D, graphical simulation, rapid and accurate 3-D modeling of complex systems. Tanks and Pipes allows users to use discrete simulation to model fluids and bulk materials.

Dash Optimization Inc., 115 River Rd., Ste. 1203, Edgewater, NJ 07020; www.dashopt.com

Booth 11

Dash Optimization Inc. provides the most advanced modeling and optimization software. Our products and services allow our clients to significantly enhance their productivity by quickly and reliably solving their hardest optimization problems. The integrated modeling and optimization capabilities of our XPRESS-MP software make it easy for companies to develop, test and solve complex models arising from a wide variety of applications.

Duxbury Press, 10 Davis Dr., Belmont, CA 94002
Booths 16 & 17

Duxbury, an imprint of Thomson Learning, is an educational publisher focusing exclusively in the fields of statistics and quantitative methods in all disciplines and at all levels of learning. Duxbury publishes many leading textbooks and student version software for OR/MS. Come by our booth and review recent works by Chris Albright, David Bell, Bob Clemen, Bob Fourer, David Gay, Ed Kao, Craig Kirkwood, Larry Lapin, Sam Savage, Art Schleifer, Linus Schrage, Wayne Winston, Chris Zappe and special student edition software by ADA, ILOG, LINDO Systems, MathSoft, Palisade and SAS Institute.

Elsevier Science, 655 Ave. of the Americas, New York, NY 10010

Booth 21

The OR/MS publication program by Elsevier Science offers comprehensive international coverage of the latest research and development in the field. Topical handbooks and a wide range of journal publications cover a wide spectrum of topics. Visit us at the booth or see a preview at www.elsevier.com/locate/orms.

e-Optimization.com

Booth 28

Launched at INFORMS is **e-optimization.com**, the Web's new information-rich meeting place for the entire optimization community. This is where you get news, share ideas, find a wealth of data, profile your organization and make new connections - from within the optimization world and far beyond. Stop by the booth to get added to the "Who's Who" section.

Frontline Systems, Inc., PO Box 4288, Incline Village, NV 89450; www.frontsys.com

Booth 7

Frontline Systems developed the Solvers/Optimizers in Microsoft Excel, Lotus 1-2-3 and Quattro Pro. Our Premium Solvers for Excel offer greater capacity, much greater speed, new diagnostic aids and our powerful Evolutionary Solver. Our Solver DLL products are used in custom applications for linear, nonlinear, non-smooth and global optimization.

IBM, 2455 South Rd., Poughkeepsie, NY 12601; kenruss@us.ibm.com

Booths 31 & 32

IBM, a world leader in optimization technology, now can integrate spatial information management with optimization technology. Exhibit demonstrations will show geographical information management tools operating synergistically with optimization tools,

applicable across a wide industry spectrum. IBM will also host 2 sessions on recent advances in optimization at IBM.

ILOG, Inc., 1080 Linda Vista Ave., Mountain View, CA 94043; www.ilog.com

Booth 30

ILOG is the world leader in optimization software. You probably already use ILOG's powerful CPLEX LP, MIP and Parallel optimizers. ILOG also provides the world's leading constraint programming and scheduling tools. New from ILOG: OPL Studio 3.0, the tool allowing rapid development of optimization applications, now including support for Visual Basic and Java programmers.

Imagine That, Inc., 6830 Via Del Oro, Ste. 230, San Jose, CA 95119; www.imaginetthatinc.com

Booth 8

Come see why Extend™ is the acknowledged standard for discrete event and continuous simulation in top universities and corporations alike. View a demonstration of powerful Extend features like top-down/bottom-up hierarchy, built-in activity-based costing, customizable animation, one-click output analysis, automatic confidence intervals, sensitivity analysis, control panel interface, interactive model execution, integrated development and authoring environments, plus hot-linking with other applications.

INFORMS, 901 Elkridge Landing Rd., Ste. 400, Linthicum, MD 21090; informs@informs.org

Booths 1 & 2

Research, networking, job placement and other benefits and services are yours when you become an INFORMS member. Visit the booth during the meeting to join INFORMS. Or, if you are already a member, stop by to meet the staff and find out more about how we can serve your needs as an OR/MS professional or student.

INFORMS-KORMS International Korea

Booth 28

We invite you to learn more about this exciting international conference to be held in Seoul, June 18-21, 2000. Conference theme is *Information & Knowledge Management in the 21st Century*.

INFORMS Miami Beach Fall 2001

Booth 30A

Mark the dates on your calendar: November 4 - 7, 2001 to attend the Miami Beach Fall 2001 Meeting. Stop by the booth for all the exciting details!

INFORMS San Antonio Fall 2000

Booth 27

Introducing the first INFORMS annual conference. An expanded scientific and social program will enhance the educational value of the conference and provide additional opportunities for networking.

Irwin/McGraw-Hill, 2 Penn Plaza, 20th Fl., New York, NY 10121-2298; mary.donnely@mcgraw-hill.com

Booths 12 & 13

Irwin/McGraw-Hill offers educators an impressive array of titles for statistics, operations management and decision science. We invite you to stop by our booths to learn more about our products, technology and services. Whether you are looking for a demonstration or have a specific inquiry, we look forward to meeting you!

John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158-0012; www.wiley.com

Booths 3 & 4

Founded in 1807, John Wiley & Sons, Inc. is an independent, global publisher of print and electronic products. Wiley specializes in scientific and technical books, journals, textbooks and education materials for colleges and universities and professional and consumer books and subscription services.

Ketron Management Science, 1755 Jefferson Davis Hwy. #901, Arlington, VA 22202; www.ketronms.com

Booth 26

Ketron Management Science concentrates on mathematical programming products and consulting. Products include C-WHIZ, linear and mixed-integer optimizer; OML, callable library of optimization and modeling functions and DATAFORM, modeling language. A user interface supplies access to all stand-alone components including a set of very useful utilities.

Kluwer Academic Publishers, 101 Philip Dr., Norwell, MA 02061; kluwer@wkap.com

Booths 22 & 23

Kluwer Academic Publishers will exhibit the latest research books and journals in the areas of OR, MS and optimization. The newly published *Handbook of SemiDefinite Programming* will be on display along with sample copies of the new journal *Information Systems Frontiers*. Please stop by our booth to pick up conference discount order forms.

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LINDO Systems Inc., 1415 North Dayton St., Chicago, IL 60622; www.lindo.com

Booth 9

LINDO Systems will highlight the recent speed enhancements to our linear and integer solvers and demonstrate the latest releases of our popular mathematical modeling packages: LINDO - our powerful linear and integer programming engine, LINGO - our integrated modeling language with linear/nonlinear solvers and What'sBest! - our large scale linear/nonlinear spreadsheet solver.

Logical Decisions, 1014 Wood Lily Dr., Golden, CO 80401; www.logicaldecisions.com

Booth 6

Logical Decisions develops state-of-the-art software, LDW, to evaluate decisions involving preference and value judgments. LDW helps users consider many attributes, separate facts, form values and explain their choices. Users organize attributes into a goals hierarchy and make judgments about their weights. LDW includes many results and sensitivity displays.

Maximal Software, Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201; www.maximal-usa.com

Booth 14

We will demonstrate the new OptiMax 2000, an extensive Component Library (API) designed to take full advantage of the *ActiveX Automation* component software technologies from Microsoft. Optimax 2000 allows the model developer to seamlessly integrate MPL into *VBA for Excel/Access*, *Visual Basic* and *Visual C++*; thus easily creating customized end-user applications to solve real-world optimization problems. We will also demonstrate the new release of MPL for Windows 5.0.

Palisade Corp., 31 Decker Rd., Newfield, NY 14867; www.palisade.com

Booth 15

Palisade Corporation is a privately owned software developer specializing in analytical software for risk and decision analysis. Our products enhance any serious decision-maker's capabilities. Palisade's product line features the DecisionTools® Suite: @RISK, TopRank®, PrecisionTree®, BestFit® and RISKview™. Also available are Evolver™, RISKOptimizer™, @RISK for Project, @RISK Developer's Kit and @RISKAccelerator.

ProModel Corp., 1875 South State, Ste. 3400, Orem, UT 84097; www.promodel.com

Booth 29

PROMODEL, the leader in the simulation industry, features a powerful, easy-to-use interface for designing and analyzing your manufacturing

processes. You can test different scenarios and find the best solution for your process. PROMODEL boasts an impressive user base. Customers have saved millions of dollars on single projects. We are the first vendor to offer a full one-year money back guarantee. Our award winning support team is dedicated to helping you succeed. ProModel Corp. offers 42 support centers worldwide to aid in your simulation projects. Stop by our booth and see what can happen with PROMODEL!

SAS Institute Inc., SAS Campus Dr., Cary, NC 27513; www.sas.com

Booth 5

Succeed in today's complex strategic planning environment with integrated, comprehensive management science solutions from SAS Institute. Stop by our booth to see why SAS customers around the world rely on our mathematical programming, project management, decision analysis and simulation software to uncover the best decisions and provide strategic decision support.

South-Western College Publishing, 10 Davis Dr., Belmont, CA 94002; www.swcollege.com

Booth 18

Welcome to South-Western College Publishing! Our position as a market leader in decision sciences and business statistics higher education is built on time-tested values and adaptability to changing market needs. Stop by our booth and you'll find a wealth of information on the latest editions by Anderson/Sweeney/Williams, Ken Black, Cliff Ragsdale and James Evans. South-Western is part of the Thomson Learning family of publishers.

Springer-Verlag New York, Inc., 175 Fifth Ave., New York, NY 10010; www.springer-ny.com

Booth 10

For more than 155 years, Springer-Verlag has published high quality books and journals covering a wide array of topics. Please visit our booth to see our very latest offerings in OR and MS, all at a discount of 20%. Check out Bonnans & Shapiro's *Perturbation Analysis of Optimization Problems* and Nocedal & Wright's *Numerical Optimization*. Pick up a sample copy of the journal *Mathematical Programming*. We look forward to seeing you there!

Wolfram Research, Inc., 100 Trade Center Dr., Champaign, IL 61820; www.wolfram.com

Booth 19

Mathematica is the world's only fully integrated technical computing system combining unrivaled computational power with unprecedented ease of use. Used by over a million scientists, engineers,

programmers and students, *Mathematica* offers unmatched ease of computation (numeric and symbolic), data visualization and programming. Fully

customizable, cross-platform, publication-quality electronic and printed documents.

Exhibitor Software Demonstrations

Sunday - Tuesday, May 7 - 9

Room 150C, Salt Palace

Remember to attend the software demonstrations to see examples of powerful software products, new releases and tools presented by some of our exhibitors at the INFORMS Salt Lake City Spring 2000 Meeting.

SC35 1:00 – 2:30pm

Maximal Software, Inc.

Bjarni Kristjansson; info@maximal-usa.com

Using the MPL OptiMax 2000 Component Library with VBA for Excel & Visual Basic

The OptiMax 2000 is a highly anticipated Component Library (API) designed to take full advantage of the ActiveX Automation component software technologies from Microsoft. Using step-by-step examples, we will demonstrate how to use the OptiMax 2000 to seamlessly integrate MPL into VBA for Excel/Access, Visual Basic, Visual C++, Delphi, Java and the Web, thus, easily creating customized end-user applications to solve real-world optimization problems.

SD35 3:00 – 4:30p

e-Optimization.com

Christelle Colin; ccolin@e-optimization.com

Come see the very first demonstration of e-optimization.com, the web's new information-rich meeting place for the entire optimization community. Find out how to get news, share ideas, access a wealth of data, profile your organization and make new connections. Attend the demo and find out how to be added to "Who's Who" and "Solutions Showcase."

Wolfram Research, Inc.

Anton Rowe

Mathematica Link for Excel - All-Purpose Excel Add-in

Link the world's most popular spreadsheet to the world's leading computational engine. Excel provides ease-of-use and interface ubiquity. *Mathematica* provides the computational power, high-quality graphics, and extensibility. You will be amazed at what you can develop inside a spreadsheet using the *Mathematica* link for Excel.

MB35 10:30a – 12:00noon

ProModel

Robert Bateman; robb@promodel.com

PROMODEL is a powerful and flexible software package that allows the optimization of a variety of

processes through simulation. It is currently used in industry to plan as well as to improve systems. PROMODEL is an ideal tool for teaching simulation and is used by major universities across the world.

ALPHATECH, Inc.

Kendra Moore & Jack Chiang;

alpha.sim@alphatech.com

ALPHA/Sim is a general purpose, discrete-event simulation tool based on Petri nets. The graphical modeling environment provides a simple yet powerful set of model building blocks, making it easy to learn and use productively. Single-user, site and educational licensing available. Platforms include PCs (NT) and Sun Workstations (SunOS or Solaris). ALPHATECH offers training, consulting and technical support.

MC35 2:15 – 3:45p

Applied Decision Analysis LLC

Andre Levy; andre.levy@us.pwcglobal.com

Introducing DPL 5.0, Decision Analysis Software

DPL is professional decision analysis software using influence diagrams, decision trees and spreadsheets. Graphical outputs include rainbow diagrams, risk profiles, policy trees and policy summaries. New in DPL 5.0: time period percentiles, 2-way rainbow diagrams and much more!

Logical Decisions

Gary R. Smith; gary@logicaldecisions.com

Improving Group Decision Making with Logical Decisions

Logical Decisions for Windows helps evaluate decisions requiring many evaluation criteria and critical preference and value judgments. LDW's many features and graphic displays make it the most powerful software in its class. The software demonstration will focus on LDW's group capabilities.

MD35 4:00 – 5:30p

LINDO Systems, Inc.

Mark Wiley; mwiley@lindo.com

Modeling with LINDO, LINGO & What'sBest!

INFORMS Salt Lake City

LINDO Systems will be highlighting the recent speed enhancements to our LP solver and demonstrating our line of popular mathematical modeling packages including new releases of: LINDO - our powerful linear and integer programming engine, LINGO - our integrated modeling language with linear/nonlinear solvers and What'sBest! - our large scale linear/nonlinear spreadsheet solver.

AutoSimulations Inc.

Tyler Phillips; tyler_phillips@autosim.com

AutoMod Simulation Software

AutoMod is one of the most powerful and flexible discrete-event simulation software packages available. AutoMod combines the ease of a simulator with the power of a simulation language and includes templates for material handling, manufacturing and continuous flow. AutoMod also supports CAD input via IGES, VRML and SDX formats. Come see why AutoMod is the simulation software of choice for a broad range of manufacturing, material handling and logistics applications.

TA35 8:30 – 10:00am

Imagine That, Inc.

David Krahl; davek@imaginethatinc.com

Simulation Modeling with Extend™

See why Extend™ is the acknowledged standard for discrete event and continuous simulation in top universities and corporations alike. See a demonstration of powerful Extend features such as top-down/bottom-up hierarchy, built-in activity-based costing, customizable animation, 1-click output analysis, automatic confidence intervals, sensitivity analysis, control panel interface, interactive model execution and authoring environments, plus hot-linking with other applications.

SAS Institute, Inc.

Ed Hughes; ed.hughes@sas.com

The SAS System: What's New in Management Science Solutions

The SAS System has recently greatly augmented its diverse array of OR and MS solutions. Many of these advances have occurred as part of our supply chain optimization initiative and illustrate how well our scheduling, optimization and other decision support capabilities can be integrated into interactive and web-based solutions.

TC35 1:00 – 2:30p

IBM

Robert H. Clark; roclark@us.ibm.com

IBM/OSL Optimizer

We will demonstrate the IBM/OSL optimizer and give the latest production announcements. There will be

ample time for questions. This presentation is intended for an audience of both academic and commercial participants.

Duxbury Press

Chris Albright; albright@indiana.edu

StatPro Statistical Add-in

StatPro is a statistical add-in for Microsoft Excel. Its capabilities span from the very basic to the advanced including stepwise regression, logistic regression, and discriminant analysis. SolverTable is an add-in for Excel that greatly simplifies sensitivity analysis and interpretation of spreadsheet models. We will demonstrate these products and answer questions about their use.

TD35 2:45 – 4:15pm

Dash Optimization, Inc.

Sebastian Ceria; sceria@dashopt.com

XPRESS-MP: A Fully Integrated Modeling & Optimization System

XPRESS-MP is a state-of-the-art software solution for modeling and optimization. We will show how XPRESS-MP can be used to model and solve complex problems arising from a wide variety of applications. We will introduce our new product EMOSL, which allows users to integrate modeling and optimization into any program, thus exploiting all computational power of our optimization engines while preserving a natural description of the problem.

ILOG, Inc.

Irv Lustig; ilustig@ilog.com

OPL Studio 3.0

ILOG will demonstrate OPL Studio 3.0, which reduces the development time for embedding optimization within your Windows and Unix applications. With OPL Studio 3.0, models developed in the OPL Studio graphical environment can be easily embedded into programs developed in Visual Basic, Java, Microsoft Excel or C++.

TE35 4:30 – 6:00pm

Frontline Systems, Inc.

Daniel H. Fylstra; dfylstra@frontsys.com

Introducing the Premium Solver Platform for Microsoft Excel

Our new Premium Solver Platform for Microsoft Excel includes a hybrid solver using evolutionary and "classic" methods for greatly improved performance and an enhanced GRG2 solver with multiple "clustering" methods for global optimization. Also included are a much-improved LP/MIP solver for mixed-integer problems and a new "all different" or permutation constraint supported by all solver engines.

Guest Program

The guest program includes a continental breakfast Monday and Tuesday, 9:00 – 10:00a, and the General Reception on Monday evening for a \$25 registration fee. Registered guests only may attend the breakfasts and must wear their name badges for admittance. Guests are not eligible to attend any of the technical sessions.

Mormon Tabernacle Choir & Crossroads of the West City Tour

Sunday, May 7 - \$22

Attend a 60-minute nationally broadcast session at Temple Square with the world renowned Mormon Tabernacle Choir. After the performance, enjoy a tour of Salt Lake, a magnificent city, built out of a desert by the industrious Mormon pioneers. This tour offers a complete look at what makes Salt Lake City so unique. You will see the historic downtown area, including the world-famous Mormon Temple, which took 40 years and 4 million dollars to build. Learn of the trials and triumphs of those hardy pioneers who transported the granite to build their temple from Little Cottonwood Canyon. Next, visit the Utah State Capitol and enjoy the surrounding drive through the residential "Avenues", an area the State and National Historic Registers have added to their listings. Then

proceed to the University of Utah, founded in 1850, the first university built west of the Mississippi. Part of your tour includes a drive through Fort Douglas, founded by Abraham Lincoln in 1862. Then you're off to Trolley Square where the knowledge of building, maintaining and operating trolley cars was developed. The antique trolley barns have been converted into an award-winning restoration that houses many unique shops, boutiques and restaurants. Trolley Square housed one of the first trolley systems.

The bus will leave from the Salt Palace Convention Center's main entrance on West Temple Street at 8:30a and will return at approximately 1:00p.

Please present the ticket included with your registration materials as you board the bus.

Plant Tour

Monday, May 8 - \$15

MSL Corporation

Take a tour of the plant that manufactures the Palm Pilot V product (formerly owned by 3Com). This tour will follow the automated production line through product testing and shipping, and will conclude with a question & answer period.

The bus will leave from the Salt Palace Convention Center's main entrance on West Temple Street at 9:30a and will return at approximately 12noon.

Please present the ticket included with your registration materials as you board the bus.

Post-Conference Tour

Be sure not to miss the first INFORMS post conference tour! A 3-day bus tour to Yellowstone Park, featuring some of the most beautiful scenery in the United States! The bus will leave from the Salt Palace Convention Center's main entrance on West Temple Street. To register, go to <http://www.western-leisure.com/>

Day 1: Wednesday, May 10 - Salt Lake to West

Yellowstone: Depart Salt Lake City at 1:00p and drive north past the Great Salt Lake, Hill Air Force Base and Ogden (Utah's first settlement). Enter Idaho and travel through the famous potato fields of this "Gem State" to your accommodations in West Yellowstone, the western gate of our nation's first national park. Overnight in West Yellowstone, Montana. (Lunch included)

Fountain Paint Pots and the spectacular "Grand Canyon of the Yellowstone." Just to the south of Yellowstone lies a jewel of mountain scenery: Grand Teton National Park. Bring plenty of extra film with you today, for these are America's youngest and most rugged mountains, and you will want to remember the day you spent exploring their majestic splendor. You'll pass by Jackson Lake and Jenny Lake's picture-postcard setting before arriving in the Western ski and summer resort town of Jackson. Spend the evening exploring the unique shops and saloons of this charming town. Overnight in Jackson. (Lunch included)

Day 2: Thursday, May 11 - Yellowstone

National Park: This is your day to explore Yellowstone! This National Park is a mysterious land of steaming geysers and bubbling mudpots - a land so amazing that the first explorers to bring back tales of Yellowstone were called liars. Visit Yellowstone's famous highlights today, including Old Faithful,

Day 3: Friday, May 12 - Jackson Hole to Salt Lake City: You will travel through 3 states today on your way back to Salt Lake City. Drive through

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rugged Snake River Canyon, pastoral Star Valley and see Bear Lake before arriving in Salt Lake City approximately 5:00p. (Lunch included)

Your tour includes: 2 nights accommodations; round trip transportation; services of a professional Western Leisure tour guide; 3 lunches; entrance fees for National Parks, monuments and museums; all luggage handling (one suitcase per person); and all necessary tips (bellmen, doormen, included meals).

Registration

• **On-Site Registration:** Registration will be on the lower level of the Salt Palace Convention Center during the following hours:

Sunday	7:30a – 5:00p
Monday	8:00a – 5:00p
Tuesday	8:00a – 5:00p
Wednesday	8:00a – 10:30a

The registration fee includes admittance to all technical sessions, to the General Reception on Monday evening and to the exhibit area. Name badges **MUST** be worn to all INFORMS sessions, functions and events. Misplaced badges may be replaced at the registration desk; your receipt must be shown for verification. Meals are not included in the registration fee. If you attend special paid events, an additional fee is required. **ALL ATTENDEES, INCLUDING CLUSTER AND SESSION CHAIRS AND SPEAKERS, MUST REGISTER AND PAY THE REGISTRATION FEE.**

Special Events

CPMS Isolated Practitioner Workshop: CPMS, the Practice Section of INFORMS, sponsors workshops on topics of interest to isolated practitioners, i.e., the Lone Rangers, of OR/MS. The 16th workshop in this series will address timely issues that affect the growing isolated practitioner community. All are welcome to participate in the workshop and discussion to be held Monday evening, 5:45 – 6:45p in Room 254C of the Salt Palace Convention Center. Wine and cheese will be served.

Forum on Women in OR/MS Events:

• **Business Meeting & Luncheon:** Everyone interested

in issues related to women professionals in OR/MS is invited to meet in Room 252B of the Salt Palace Convention Center at lunch on Monday from 12noon – 1:00p. Bring a bag lunch for a lively discussion at our meeting.

• **Reception:** The Reception for Women in OR/MS will be held on Sunday from 7:00 – 9:00p in Parlay 1 & 2 of the Wyndham Hotel. This is a great chance to meet other women who are practicing, teaching and researching OR/MS.

General Reception: Meeting participants and their registered guests are welcome to attend

Not included: Meals (other than mentioned in the itinerary); items of a personal nature (i.e., room service, telephone, liquor, valet, etc.).

Price per Person: Based on 2-passenger minimum - Double: \$329.00; Single: \$439.00; Triple: \$289.00; Child: \$209.00 - Child rate applies for children under age 12 staying in room with full-paying adult.

• Rates

Deadline Dates	On/Before 4/3	After 4/3
INFORMS Members	\$225	\$250
Non-members	\$265	\$290
Students/Retired	\$65	\$65
Guests	\$25	\$25
Workshop	\$25	\$25

• **Refund & Cancellation Policy:** Registration payments will be refunded only if a written cancellation is received in the Rhode Island office no later than **April 28th**. Cancellations may be faxed to 401-274-3189 or e-mailed to meetings@informs.org and must meet this deadline.

• **Special Services & Assistance:** If you require special accommodations or services for hotel rooms, session rooms or special events, please contact Cheryl Clark at 800-343-0062/401-274-2525, ext. 211 or via e-mail at cheryl.clark@informs.org.

the General Reception on Monday evening from 7:30 – 9:30p in the Grand Ballroom of the Marriott Downtown.

IFORS Distinguished

Lecture: Thomas Magnanti will be the second speaker in a continuing series of Distinguished Lectures sponsored by IFORS, The International Federation of Operational Research Societies. IFORS is an international organization of national OR societies whose primary purpose is the advancement of OR in all nations of the world. Thomas Magnanti, INFORMS Past President and Dean of the

School of Engineering at MIT, will present "or.edu & technology.com" on Tuesday, May 9th from 8:30 - 10:00a in Room 151G of the Salt Palace Convention Center. Everyone is welcome to attend.

INFORMS Membership Meeting: The INFORMS Membership Meeting will be held on Saturday, May 6th from 5:00 - 6:00p in Room 250A-C of the Salt Palace Convention Center. Wine and cheese will be served.

Job Fair: On Sunday, the INFORMS Job Placement Service will hold its Spring Job Fair from 12noon - 2:00p in the Exhibit Hall, located in the Ballroom on the Lower Level of the Salt Palace Convention Center. Representatives of major OR/MS employers will be available to meet with job seekers and set up on-site interviews. Bring copies of your resume.

- **Job Seekers:** The Job Fair is open to all INFORMS members who have signed up with JPS. JPS provides online job listings to read and provides employers with online access to your resume. The service is FREE for INFORMS members; there is a nominal charge for non-members. You may sign up via the INFORMS website at www.informs.org.

- **Employers:** Participation in the Job Fair is open to all employers enrolled in JPS on a first-come, first-served basis. JPS provides an online listing of your job opening, online access to resumes of job seekers and a downloadable database of these resumes. To sign up with JPS, use the INFORMS website at www.informs.org or contact Tina Watkins at 800-446-3676/410-691-7850 if you don't have Internet access. There is a

charge of \$200 for the first job listing; additional job listings from the same organization are \$100 apiece.

There is a nominal fee of \$20 to participate in the Job Fair. We will provide a table, chairs and a sign with your organization's name. You are encouraged to bring your own recruiting literature and are welcome to bring your own (small) display.

The Military Applications Society Session Honoring Dr. Seth Bonder

In this session, Dr. Peter Cherry will discuss Dr. Bonder's contribution to Military Operations Research. Dr. Bruce Fowler, Chair of the Military Applications Society, will present the Steinhart Award to Dr. Bonder, who will present the Steinhart Award Lecture, "Versatility Planning: An Idea Whose Time has Come - Again."

Everyone is welcome to attend this session on Tuesday from 2:45 - 4:15p in Room 253B of the Salt Palace Convention Center.

2000 George E. Nicholson Student Paper Prize Competition:

Selected finalists in the George E. Nicholson Student Paper Prize Competition will present their work on Sunday, May 7th in 2 back-to-back sessions from 1:00 - 4:30p in Room 150D of the Salt Palace Convention Center. These sessions represent an opportunity for faculty, professionals and other students to see some of the best research being performed by students. Winners will be announced at the Welcome & Awards Session on Monday.

Student Reception: The Student Reception will be held in Salon F of the Marriott Downtown on Sunday from 7:00 - 9:00pm. Use this opportunity to meet other students and expand your network base. All registered student attendees welcome. **Please present the ticket included with your registration materials for admittance.**

Second Teaching Effectiveness Colloquium (TEC II):

Scheduled for the weekend prior to the INFORMS Salt Lake City Meeting, TEC II will be similar to TEC I in nature and format. The event comprises a series of pedagogically-oriented 1- and 2-hour sessions and workshops, will take place from the evening of Friday, May 5 through noon on Sunday, May 7. The purpose is to expose INFORMS members to a wide variety of creative approaches for teaching OR and MS. Ten respected and innovative instructors from INFORMS' constituent disciplines will present and demonstrate their methods for participants. Many will provide live demonstrations that offer an opportunity to actively participate.

Topics include effective evaluation of instruction, selling MS in a faculty of business, effective management of large classes, fostering active learning in virtual classrooms, running a modeling studio and effective classroom use of cases. Colloquium presenters include John Birge, Sherwood Frey, Erhan Erkut, Armann Ingolfsson, Donna Llewellyn, Bill McKeachie, Steve Pollack and Susan Sanchez.

Colloquium registration fees are \$60.00 for PhD students and \$150.00 for all other INFORMS

INFORMS Salt Lake City

registrants. All Colloquium participants must also register concurrently for the INFORMS Meeting and pre-registration is required. To be eligible, a PhD student must be enrolled in a PhD program in one of INFORMS' constituent disciplines, have an interest in teaching and have completed all of their PhD course work. This should be documented with a letter from their advisor certifying the student's status; this can be e-mailed to meetings@informs.org or faxed to 401-274-3189.

The registration fee includes participation in all Colloquium

sessions, all handouts and Colloquium-associated materials, dinner on Friday, breakfast and lunch on Saturday, breakfast on Sunday and breaks throughout the Colloquium. Registrants are responsible for their travel and hotel accommodations and are also required to pre-register for the INFORMS Meeting.

Teacher Program: The middle/high school/community college math and science teachers program will be composed of introductory OR and computer application presentations, followed by teacher hands-on participation.

Probability modeling, computer simulations, queueing (waiting line) models and linear programming models will follow an introduction to OR/MS. Attendees, who are also welcome to attend the general conference, will each receive copies of all program materials: videos, software packages with instructions and teacher/student activity guides and Teacher Introduction Modules. The program will be held on Monday from 8:00a - 3:00p in the Wasatch 2 Room of the Wyndham Hotel.

Technical Program

29th Annual Franz Edelman Award for Achievement in OR/MS Competition Presentations

Six finalists will vie for the 29th Franz Edelman Award for Achievement in Operations Research and Management Science. The work presented by the finalists ranges across a wide variety of applications, including airline crew scheduling, supply chain management for auto parts and microelectronics, airport arrival scheduling, catalog response optimization, automobile prototype optimization and production planning. Russell Labe, Chair of the 2000 competition, announced the following finalists: Air New Zealand, Federal Aviation Administration, Fingerhut Companies, Inc., Ford, IBM and Jeppesen Sanderson, Inc.

The finalist presentations will be held on Sunday, May 7, in Wasatch 1 & 2 meeting rooms located in the Wyndham Hotel. All those interested in the practice of OR and MS are invited to attend the day-long competition. The registration fee is \$99 and includes lunch on Sunday and a luncheon on Monday. To register, go to www.informs.org/Conf/SaltLake2000/. The winning presentation will be announced during the Welcome and Awards Session on Monday, May 8 in Room 250 of the Salt Palace Convention Center from 8:30 - 10:00a.

This is the 29th year the prestigious \$15,000 competition has been held. The award is jointly sponsored by INFORMS and CPMS, the Practice Section of INFORMS. The Edelman award recognizes outstanding implemented work that has had a significant positive impact on the performance of the client organization. The top finalist receives a \$10,000 first prize. The work to be presented is briefly described:

Air New Zealand: *Optimized Crew Scheduling at Air New Zealand*

E. Rod Butchers, Paul R. Day, Andrew P. Goldie, Jeff A. Meyer, Stephen Miller, David M. Ryan, Amanda C. Scott, Jim R. F. Waite

The airline crew scheduling problem consists of the pairings problem involving the generation of minimum-cost pairings (sequences of duty periods) to cover all scheduled flights, and the rostering problem involving

the assignment of pairings to individual crewmembers. Over the past 15 years, 8 application-specific optimization-based computer systems have been developed in collaboration with the University of Auckland to solve all aspects of the pairings and rostering processes for Air New Zealand's National and International operations. These systems have produced large savings, while also providing crew rosters that better respect crew preferences.

Federal Administration: *Delay Enhancements Collaborative Making*

Mike Wambsganss, Midori Tanino, Kan Chang, Lara Shisler, Ken Howard, Rick Oiesen

When airport arrival capacity is reduced, the demand placed by arriving aircraft may be too great. In these cases a GDP is used to delay flights before departure at their origin airport,

Aviation *Ground Program under Decision*

keeping traffic at an acceptable level for the impacted arrival airport. However, GDPs sometimes lacked current data and a common situational awareness. Working with the FAA and airline community, Metron, Inc. and Volpe National Transportation Systems Center improved the process by utilizing real-time data exchange between all users, new algorithms to assign flight arrival slots and new software in place at FAA facilities and airlines.

Fingerhut Companies, Inc.:
Mail Stream Optimization

Randy Erdahl, Deb Campbell, Doug Johnson, Eric Bibelnieks, Mark Bullock, Mike Haydock, Harlan Crowder

Fingerhut mails up to 120 catalogs per year to each of its 6 million customers. With this dense mail plan and independent mailing decisions, many customers were receiving redundant and unproductive catalogs. To find and eliminate these unproductive catalogs, optimization models were developed to select the optimal sequence of catalogs, called a "mail stream," for each customer. With mail streams, Fingerhut is able to make mailing decisions at the customer level as well as increase profits. Today, this application runs weekly using current data to find the most profitable mail stream for each of its 6 million customers.

Ford: Rightsizing & Management of Prototype Vehicle Testing at Ford Motor Company

Kenneth Chelst, John Sidelko, Alex Przebienda, Jeffrey Lockledge, Dimitrios Mihailidis

Prototype vehicles are used to verify new designs and represent a major annual investment at Ford Motor Company. Engineering managers studying in a Wayne State University master's degree program adapted a classroom set covering example and launched the development of the Prototype Optimization Model (POM). The POM is used for both operational and strategic planning. The modeling approach was lean and rapid and was designed to maintain the role of the experienced manager as the ultimate decision-maker.

IBM: Matching Assets with Demand in Supply Chain Management at IBM Microelectronics

Peter Lyon, R. John Milne, Robert Orzell, Robert Rice

The IBM Microelectronics Division is a leading-edge producer of semiconductor and packaged solutions supplying a wide range of customers inside and outside IBM. A critical component of customer responsiveness is matching assets with demand to correctly assess anticipated supplies linked with demand and provide manufacturing guidelines. A

suite of tools was developed to handle matching in a division-wide "best can do," division-wide ATP and daily individual manufacturing location MRPs. The key modeling advance is the dynamic interweaving of linear programming, traditional MRP explosion and implosion-based heuristics and the ability to harness deep computing to solve large linear programming problems.

Jeppesen Sanderson, Inc.:
Flexible Planning & Technology Management at Jeppesen Sanderson, Inc.

Elena Katok, William Tarantino, Ralph Tiedeman

Jeppesen Sanderson, Inc., the world's leader in aviation information, maintains, manufactures and distributes flight manuals with critical safety information for over 300,000 pilots worldwide. Jeppesen's customer service level began to deteriorate when a growing product line of more than 100,000 charts overwhelmed its production system. We developed a suite of optimization-based decision support tools that improved planning in each production area and revealed the value of OR/MS to Jeppesen managers. Two years later, Jeppesen is fully committed to OR/MS, with OR-based decision support systems spreading to all areas of the company and realized cost reductions of \$3 million.

Plenary Presentations

Sunday, May 7, 5:00 - 6:00p, Room 250, Salt Palace

Twenty-First Omega Rho Distinguished Lecture: Policy Modeling for Better Decisions: The Case of HIV Prevention

Edward H. Kaplan, Yale School of Management, Yale School of Medicine, Yale Center for Interdisciplinary Research on AIDS; edward.kaplan@yale.edu; <http://info.med.yale.edu/eph/cira/faculty/kaplan.html>

Abstract: HIV prevention programs are intended to slow the spread of the AIDS virus in the population, so it is not surprising that much of HIV prevention research has focused on evaluating the success (or lack thereof) of alternative interventions. Knowing whether programs "work" is necessary for constructing a coordinated HIV prevention strategy, and mathematical models have proven useful in estimating the effectiveness of alternative prevention programs. However, public funds for HIV prevention are limited: the 1999 US Federal Budget allocated \$775.3 million to HIV prevention activities (about 8% of total federal AIDS spending or 4/10,000ths of the total 1999 budget). Building a portfolio of prevention programs in such a resource-constrained environment requires thinking about HIV prevention as a function of investment. The question is not whether programs succeed or fail, but rather how to form an effective portfolio of programs within a budget constraint. Over the past few years, researchers and policy officials in the US and abroad have paid increasing attention to this issue. Focusing on the decisions faced by public officials, mathematical models that link the operations of HIV prevention programs to epidemic outcomes and/or estimate the cost-effectiveness of programs in preventing new infections are in demand. This presentation will review and expand upon the issues raised above, often via recourse to selected HIV prevention activities and associated policy models.

Biography: Edward H. Kaplan, PhD, obtained his BA from McGill University in 1977 with First Class Honors in Economic and Urban Geography. He proceeded to graduate study at MIT where he completed 3 masters degrees (OR 1979, City Planning 1979 and Statistics 1982) in addition to his 1984 doctorate in Urban Studies. He currently serves as Professor of MS at the Yale School of Management, Professor of Public Health at the Yale School of Medicine and Director of the Law, Policy and Ethics Core at Yale's Center for Interdisciplinary Research on AIDS.

Professor Kaplan is an expert in OR and statistics who has developed novel methods for quantitatively evaluating HIV intervention programs. He is the author of more than 80 peer-reviewed publications. He has received the 1994 Lanchester Prize and the 1992 Franz Edelman MS Achievement Award. Professor Kaplan was twice awarded the Lady Davis Visiting Professorship at the Hebrew University of Jerusalem. Kaplan's current research links the operations of HIV prevention programs to epidemic outcomes, examines the cost-effectiveness of individual intervention programs and proposes approaches to allocating HIV prevention resources.

His research demonstrating the effectiveness of New Haven's needle exchange program remains among the most creative and important examples of HIV



program evaluation to date. Kaplan was awarded the Connecticut Health Commissioner's AIDS Leadership Award in 1991, the New Haven Foundation's Ivy Award in 1991 and the Hiscock Award of the Connecticut Public Health Association in 1997. His research has been cited numerous times by cities and states that have created legal needle exchange programs and received widespread media coverage.

Professor Kaplan teaches courses in Policy Modeling, OR and Data Analysis and Statistics at Yale. He has also taught and/or held visiting appointments at MIT's Sloan School, the Technion-Israel Institute of Technology, the Hebrew University of Jerusalem, the Survey Research Center at UC Berkeley, the Kennedy School at Harvard University and the College of Management at UMASS/Boston. He is the Area Editor for Policy Modeling and Public Sector OR for *Operations Research* and serves on the editorial boards of the *Journal of AIDS, Health Care Management Science* and the *Journal of Mathematics Applied in Medicine and Biology*. He served on the Scientific Program Committee for the 12th World AIDS Conference in Geneva. Currently, he is on the Advisory Board of Carnegie Mellon University's Heinz School of Public Policy and Management, the Scientific Advisory Board of the American Foundation for AIDS Research and the Institute of Medicine's Committee on HIV Prevention Strategies.

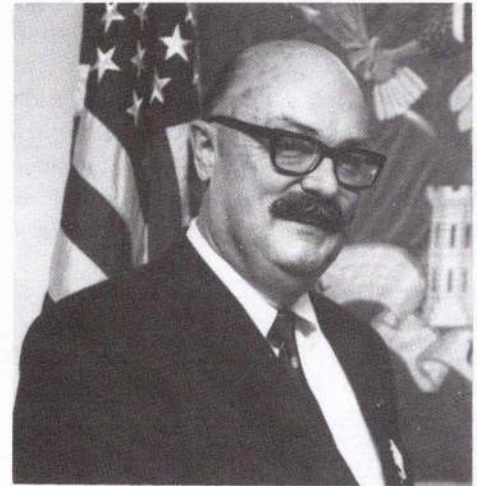
Monday, May 8, 1:00 - 2:00p, Room 250, Salt Palace

Invited Plenary: On Doing Well by Doing Good

Gene Woolsey, Colorado School of Mines;
rwoolsey@mines.edu

Abstract: This presentation outlines the applied Operations Research Program at the Colorado School of Mines as of December 1999. Now in its 29th year of operation, the program boasts more than 300 graduates scattered all over the world. The program focuses first and foremost on real-world applications. All students are required to complete one or more real-world *Pro Bono Publico* projects in either the public or private sector. Those students, who, before or after graduation, have done projects that save in excess of \$1,000,000 in one calendar year, are awarded a diamond stickpin. At present, the program's current and former students have generated verified savings to the public and private sector in excess of \$267,614,918.

Letters of verification for the previous number will be presented and the projects discussed. Further, we have a placement rate, within 6 months of graduation, in excess of 98% over 29 years. This presentation will tell you how we did it, and how you could also.



Biography: Gene Woolsey is the director of the Management Science/Operations Management Program at the Colorado School of Mines. He is past international president of The Institute of Management Sciences (now INFORMS). He is the first recipient of the Harold Larnder Prize for Distinguished International Achievement in Operations Research. One of the areas of research in which he participated effectively doubled the world supplies of Lithium. He is the editor emeritus of the *Production & Inventory Management Journal*, *Interfaces*, the practice Journal of INFORMS, *The Journal of Operations Management*, *The Transactions of the Institute of Industrial Engineers* and *The Colorado School of Mines Quarterly of Science and Engineering*. He has held, or still holds presently, adjunct or visiting teaching positions at 7 other colleges or universities in 4 countries. He has written

8 books in MS/operations management, production scheduling, assignment and distribution, LP and OR and engineering design using geometric programming. He has more than 100 published papers. For the past decade, he has worked *Pro Bono Publico* for any religious group or government agency of any government of sufficiently conservative, capitalist form with which he politically agrees. For this work, he has been given the Logistics Badge (Honorary) of the Israeli Air Force for logistical work done for them and has been awarded the Commander's Medal, the Outstanding Civilian Service Medal and the Distinguished Civilian Service Medal of the US Department of the Army. He was also elected a "Colonel of Regiment" for the 115th Engineers. In 1999 he was given the INFORMS Award for the Teaching of OR/MS Practice.

Tuesday, May 9, 10:30 - 11:30a, Room 250, Salt Palace

Invited Plenary: Internet Technology at Western Governors University

Robert W. Mendenhall, Western Governors University; rwm@wgu.edu

Abstract: Bob Mendenhall is President of Western Governors University, WGU. WGU is a competency-based, degree-granting, online university that delivers cost-effective education using the Internet and other advanced telecommunications and networking technologies. Founded by the Governors of 19 western states, WGU's mission is to expand educational opportunities for learners everywhere by offering online access to classes from universities, colleges and corporate training programs through its unique online catalog. Current WGU degree offerings include: Associate of Arts, Associate of Applied

Science in Network Administration, Associate of Applied Science in Electronics Manufacturing Technology, Associate of Applied Science in Software Applications Analysis & Integration and a Master of Arts in Learning & Technology. President Mendenhall will address the historical development, current status and future direction of WGU and how Internet technology is changing the paradigms of higher education as well as the implications for learning and teaching.

Biography: Robert W. Mendenhall is the President and CEO of Western Governors University in Salt Lake City, Utah. Bob has more than 20 years of experience in the development, marketing and delivery of technology-based education. He received his Bachelors degree from Brigham Young University and is currently completing his doctorate in instructional technology at BYU. For several years he has had his own consulting business and previously

was general manager of IBM's K-12 education division. He has served as executive vice president of Jostens Learning Corporation. From 1980 through 1991, he was a founder, president and CEO (from 1987) of Wicat Systems, Inc., a leader in providing computer-based curriculum, instructional management and testing to schools and technology-based training to government and industry.

Invited Tutorials

SC13 - Tutorial: Combinatorial Optimization: Current Successes & Directions for the Future

Karla L. Hoffman, George Mason University; khoffman@vms1.gmu.edu

Our ability to solve large, important combinatorial optimization problems has improved dramatically in the decade. The availability of reliable software, extremely fast and inexpensive hardware and high-level languages that make the modeling of complex problems much faster have led to a much greater demand for optimization tools. This presentation will provide an overview of some of strategies for modeling and solving such problems. Model formulation, preprocessing, heuristics, cutting-plane techniques and column-generation approaches will be presented as well as the presentation of a general framework that will allow all such strategies to be combined into an overall optimization software. The presentation highlights the major breakthroughs and then describes some very exciting future opportunities. With the information-technology revolution taking place currently, we now have the opportunity to have our tools embedded into supply-chain systems that determine production and distribution schedules, process-design and location-allocation decisions. These tools can be used industry-wide with only minor modifications being done by each user.

SD34 - Tutorial: Using VBA in a Management Science Course

S. Christian Albright, Indiana University; albright@indiana.edu

In this tutorial, I will explain how I incorporate VBA into an MS course. I have been doing this for several years, and it has been very successful. Instead of learning "only" how to develop spreadsheet models, the students learn how to wrap these in DSSs that enable a non-technical end-user to generate user-friendly reports by simply entering the appropriate inputs. Admittedly, programming is probably not suitable for all MS courses, but I have found it to be a welcome break from a continual semester's worth of modeling. There are 2 possible downsides to this approach. The first is that it takes time away from

the modeling part of the course – there are fewer models that we can cover. I have not found this to be a significant disadvantage for business students in my area, some of whom will find the programming skills more important to their future careers than the modeling skills. The second downside is the lack of textbooks: there are none! I am currently in the process of writing a *VBA for Modelers* book that will supplement the upcoming second edition of the *Practical Management Science* textbook by Wayne Winston and myself. I will share some of the materials from this VBA book during the session and will demonstrate some of the applications I have developed in class.

MB33 - Tutorial: The Spread & Nature of Automated Advisory Services on the Web: Perspectives from a dot.com Launch

Edward S. Robins; erobins@technologyevaluation.com

Automated advisory services (AAS) lends itself naturally to the Web environment. AAS consists of a means of accumulating and cross-referencing data from as many sources as possible to build, populate and refine decision models in as automated a way as possible. A special client version of the tool is then made available (usually for a fee) with guided assistance to aid a decision-maker in reaching a decision for their given situation. The art of using decision science in the web environment is discussed as well as how Technologyevaluation.com has moved from being a software decision support development and research company to a successful Web-based AAS organization with a monthly audience exceeding a quarter of a million users per month - and growing.

MD21 - Tutorial: Experimental Design for Simulation

W. David Kelton, University of Cincinnati; david.kelton@uc.edu

This tutorial covers challenges, solutions and opportunities when experimenting with simulations. Careful design of simulation experiments is essential, saving time and effort by providing efficient ways to estimate effects of changes in the inputs on the

outputs. Traditional experimental-design methods are discussed, as are broader questions about planning computer-simulation experiments.

TC14 - Tutorial: Optimization in Medical Diagnosis & Treatment

Ariela Sofer, George Mason University; asofer@gmu.edu

In the past few years, optimization has emerged as a promising tool in solving medical diagnosis and treatment planning problems. However, because of the size and complexity of these problems, optimization is not yet used routinely in clinical settings. This tutorial gives an overview of optimization in medical image reconstruction and

radiation therapy planning. We discuss the problems, their associated models, existing solution methods and opportunities for future research.

TD05 - Tutorial: Machine Scheduling with Availability Constraints

Chung-Yee Lee, Texas A&M University; cylee@acs.tamu.edu

The majority of scheduling literature assumes that the machines are available at all times. This tutorial presents recent results for machine scheduling problems where machines may not always be available due to maintenance, breakdown or processing jobs that were scheduled in the previous planning horizon.

Workshop

Wolfram Research, Inc.

\$25

Sunday, May 7, 8:00a – 12noon

Salon B, Marriott

Mathematica is the tool of choice at the frontiers of scientific research, in engineering and financial analysis and modeling and wherever quantitative

methods are used. This workshop is for novices as well as advanced users and will provide an understanding of what *Mathematica* is and how it can help them in their daily work. Topics include an introduction to *Mathematica*, an overview of new features and benefits in Version 4, *Mathematica* application packages and special topics in OR.

INFORMS Salt Lake City

Planner

SUNDAY	MONDAY	TUESDAY	WEDNESDAY
	<p>Welcome & Awards 8:30 - 10:00</p>	<p>TA 8:30 - 10:00</p>	<p>WA 8:30 - 10:00</p>
	<p>MB 10:30 - 12:00</p>	<p>INFORMS Plenary 10:30 - 11:30 Robert Mendenhall</p>	<p>WB 10:15 - 11:45</p>
<p>SC 1:00 - 2:30</p>	<p>INFORMS Plenary 1:00 - 2:00 Gene Woolsey</p>	<p>TC 1:00 - 2:30</p>	
<p>SD 3:00 - 4:30</p>	<p>MC 2:15 - 3:45</p>	<p>TD 2:45 - 4:15</p>	
<p>Omega Rho Plenary 5:00 - 6:00 Edward Kaplan</p>	<p>MD 4:00 - 5:30</p>	<p>TE 4:30 - 6:00</p>	

Sunday 13:00-14:30**SC01 Decision Analysis Arcade: Innovations in Practice**

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Dana R. Clyman, University of Virginia, Darden Grad Sch. of Bus. Adm., Charlottesville, VA 22906-6550

1) Valuance: Decision Analysis for the Management of an Arbitrary Process, John Andrews

Valuance is a new framework for applied decision theory, involving more general value-function modeling and a recording system that tracks results in the same terms as projected by the decision analysis model. This provides a generalization of traditional accounting, which remains a special case. We demonstrate with a case study.

2) Decision & Risk Analysis Applied to the Adaptive Enterprise Concept, Daniel Owen, Strategic Business Processes, Michael Kusnic, Deborah K. Bosch

D&RA enables adaptive enterprises by identifying and sensing critical uncertainties and possibilities. Two important D&RA structures follow. "Potential customer value" (net surplus) has 7 customer-perceivable attributes. Assessments about future customer desires and company abilities become internal free-market signals. Hybrid solutions from rapid, continuous change models are robust under discontinuous change.

3) Predicting the Decision-Aiding Value of Decision Research, Rex Brown, George Mason University

Decision-making generally needs improvement, yet decision-aiding remains primitive. Advances must leverage practitioner experience; however, researchers tend toward what is scientifically attractive rather than useful. Useful research should be rewarded and its practical impact must be cheaply evaluated. A decision theoretic measure is proposed for evaluating, comparing and prioritizing research projects.

SC02 Monte Carlo Methods in Decision Analysis

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Prakash P. Shenoy, University of Kansas, School of Bus., Summerfield Hall, Lawrence, KS 66045-2003

1) Computational Methods in Decision Analysis: A Comparative Review, Concha Bielza, Universidad Politecnica de Madrid, Fac. de Informatica, Madrid, 28660, Spain, David Rios Insua

We review and compare computationally various simulation-based approaches to decision analysis. We consider variants of deterministic methods to account for errors in the expected utility approximation, sample path methods and augmented simulation methods.

2) Foreign Exchange & Lost Opportunity in the US Department of Defense, James C. Felli, Naval Postgraduate School, DRMI (64FL), 1522 Cunningham Rd., Monterey, CA 93943-5201

Using data from the US Air Force and Monte Carlo simulation within a decision analytic framework, we demonstrate how the use of forward foreign exchange contracts and currency options can reduce the financial impact of currency fluctuation for the US DoD.

3) A Markov Chain Monte Carlo Method for Solving Multi-Stage Decision Problems, Prakash P. Shenoy, University of Kansas, School of Bus., Summerfield Hall, Lawrence, KS 66045-2003, John M. Charnes

We describe an MCMC method for solving multi-stage decision problems. We start with a valuation network representation that describes a factorization of the joint probability distribution and a factorization of the joint utility function. We decompose the problem into stages and solve each stage using MCMC sampling techniques.

4) A Specialized Partially Observed Markov Decision Problem Form & Algorithm for Clinical Patient Management, Niels Peek, Utrecht University, Dept. of Computer Sci., Utrecht, 3508 TB, The Netherlands

We will describe a special form of POMDP tailored to a particular clinical patient management problem. We will also describe a new solution method based on Monte Carlo simulation for solving such POMDP representations.

SC03 New Technologies & their Impact on Models & Simulation

Sponsor: Military Applications Society
Sponsored Session

Chair: Dean S. Hartley, III, Oak Ridge National Labs., 1099 Commerce Park, Oak Ridge, TN 37830

1) JIDPS: Rapid Database Production: Freeing the Beast of Burden, Andy Hernandez, USJFCOM's Joint Warfighting Center, JIDPS/JTLS PM, Suffolk, VA, hernanda@jwfc.jfcom.mil

2) Low Cost Dynamic Random Access Memory & its Impact on Future Simulation Capabilities: A Case Study, Ralph M. Toms, SRI International, Systems Development Div., 333 Ravenswood Ave., Menlo Park, CA 94025, ralph_toms@sri.com

3) The Future of DoD Analysis, Dean S. Hartley, III, Oak Ridge National Labs., 1099 Commerce Park, Oak Ridge, TN 37830**SC04 Military Analysis I**

Contributed Session

Chair: Robert T. Brigantic, USAF, 906 Shadow Ridge Crossing, O'Fallon, IL 62269, robert.brigantic@scott.af.mil

1) Modeling & Simulation on Remote Engagement Capability, Hideaki Yoshikura, Mitsubishi Electric Corp., 325 Kamimachiya, Kamakura, Kanagawa, 247-8520, Japan, hideaki.yoshikura@kama.melco.co.jp

Modeling and simulation methodology on ship-based remote engagement capability is introduced on the basis of current radar and communication technology. The main focus is on data communication network analysis and radar track error resulting from communication delay and coordinate conversion error. Data communication analysis is discussed on the basis of state-of-the-art phased array antenna technology...

2) Modeling & Simulation of Distributed Interactive Stochastic Combat Networks, Yoon G. Hong, Hansung University, Dept. of IE, 389 2-Ka Samsun-dong Sungbukku, Seoul, 136-792, Korea, yhong@hansung.ac.kr, Soon J. Kwon

We discuss modeling and simulation of a stochastic combat network through Internet space. Two separate models, for both clients and server, are considered and validated for conducting studies with these models. Some important combat measures and their relative difference computations between models were made.

3) Aligning Defense Logistics Strategies, Eleanor Winn Reid, DLA Office of OR & Resource Analysis, Richmond, VA, ereid@dscr.dla.mil

The Defense Logistics Agency (DLA) serves within the DoD as a wholesale level manager of various commodities and services. In supporting its military service customers, the DLA is continually faced with the decision of how best to provide improved levels of customer support while at the same time reducing resources and costs...

4) withdrawn - author request of 4/3, Robert T. Brigantic, USAF, 906 Shadow Ridge Crossing, O'Fallon, IL 62269, robert.brigantic@scott.af.mil**SC05 Nicholson Student Paper Prize Competition I Prize Session**

Chair: Noah F. Gans, University of Pennsylvania, OPIM Dept., The Wharton School, Philadelphia, PA 19104-6366, gans@wharton.upenn.edu

1) Nicholson Student Paper Prize Competition

This session features selected finalists in the Nicholson Student Paper Prize Competition. It represents an opportunity for faculty, professionals and other students to see some of the best research being performed by students. All are welcome.

SC06 Panel: Designing Services for the 21st Century - Issues & Opportunities

Cluster: Service Design
Invited Session

Chair: Terry Hill, London Business School, Sussex Place, Regent's Park, London, NW1 4SA, UK

1) Panel: Designing Services for the 21st Century: Issues & Opportunities, Aleda V. Roth, University of North Carolina, Kenan-Flagler Bus. Sch., CB 3490, McColl Bldg., Chapel Hill, NC 27599-3490, aleda_roth@unc.edu, Richard B. Chase, University of

Southern California, Marshall Sch. of Bus., Marshall Bridge Hall 400, Los Angeles, CA 90089-1421, **Gary M. Thompson**, Cornell University, Sch. of Hotel Admin., Ithaca, NY 14853, gmt1@cornell.edu, **Rohit Verma**, DePaul University, Dept. of Mgmt., 1 East Jackson Blvd., Chicago, IL 60604, rverma@condor.depaul.edu

As we move from "post-industrial" economy to "service" economy to "experience" economy, what are the emerging issues facing service design? This panel will discuss new opportunities for service design research in the coming years.

SC07 Manufacturing Improvement

Contributed Session

Chair: Z. Reza Farahani, Sharif University of Technology, Tehran, 11365, Iran

1) **The Increase of Reliability of Work of Automated Assembly Systems by Optimizing Time Technological Chains**, **Evgeniy V. I. Konoplyanchenko**, Laboratory of Automization of Manufacture, R-Korsakov St 34/50, Sumy UA, 40007, Ukraine, mech@sau.sumy.ua

Changing an organization of moving the products during constantly brings about one and same result: changes a total idle time values of equipment, changes duration of production cycle and changes a total wait time of items that being about WIP change. The new forms of organization of productions are submitted...

2) **The Design of Object-Oriented Architecture for Shop-Floor Planning & Control Systems**, **Sanghyeok Seo**, Korea University, Dept. of IE, 1, 5-ka Anam-dong, Sungbuk-ku, Seoul, 136-701, Korea, charmi@ie.korea.ac.kr, **SungSchick Kim**

A new object-oriented architecture for a shop-floor planning and control software system is presented. Analysis and design of the architecture was performed with the UML. With this architecture, developers can build a system by only setting the properties of some basic classes and making the relationship of these classes without knowing which data is necessary.

3) **Utilizing Forecast Band Refinement for Capacitated Production Planning**, **Philip M. Kaminsky**, University of California, Haas Sch. of Bus., Berkeley, CA 94720, kaminsky@ieor.berkeley.edu, **Jayashankar Swaminathan**

We present a model for forecast evolution and develop a capacitated production planning model for a single product with terminal demand. We characterize the optimal production policy under this forecast evolution process and develop effective heuristics. Finally, we computationally compare the effect of forecast information update patterns on optimal costs.

4) **Projective Feature Recognition for CAPP**, **Hyun Chan Lee**, Hongik University, IE Dept., 72-1 Sangsoo-dong, Mapo-Gu, Seoul, 121-791, Korea, hlee@wow.hongik.ac.kr, http://cadcam.hihome.com/

A feature recognition algorithm for 2.5 dimensional objects is proposed using orthogonal projection. The proposed algorithm takes process planning into consideration. This algorithm is implemented in C++. By applying the algorithm to practical complicated examples, we verify that the algorithm is working very well.

5) **A Branch & Bound Method for AGV Flow Path Designing in Conventional Systems**, **Z. Reza Farahani**, Sharif University of Technology, Tehran, 11365, Iran

A new efficient B&B method will be presented for designing AGV flow-path in conventional (unidirectional) systems. This algorithm is optimal and searches based only on feasible solution by DFS algorithms that have not been proposed by prior algorithms.

SC08 Probabilistic Models in Telecommunications

Sponsor: Applied Probability Society

Sponsored Session

Chair: Natarajan Gautam, Pennsylvania State University, Dept. of IME, 207 Hammond Bldg., University Park, PA 16802, ngautam@psu.edu

1) **Queueing Models for Optimal Segmentation of Local Area Networks**, **Shaler Stidham, Jr.**, University of North Carolina, Dept. of OR, CB# 3180, Smith Bldg., Chapel Hill, NC 27599, sandy@email.unc.edu

Continuing work begun in a previous paper, we consider optimal design models for deciding how to segment a LAN in order to minimize the sum of hardware costs and the costs of waiting for a token. The results depend crucially on whether the network demands are homogeneous or non-homogeneous.

2) **Cooperative & Non-Cooperative Rate-Based Flow Control**

Algorithms in a Multi-Class Communication Network, **Christopher M. Rump**, SUNY, Dept. of IE, 405 Bell Hall, Buffalo, NY 14260-2050, crump@eng.buffalo.edu, http://www.acsu.buffalo.edu/~crump/

We consider rate-based flow control algorithms in a communication network in which several user classes share network resources. Each class seeks to choose a flow strategy that will maximize the net benefit received. In this context, we compare Pareto optimal solutions of a cooperative environment to Nash equilibrium solutions within a competitive environment.

3) **Performance Analysis of Web Proxy-Servers & Mirror Sites using a Queueing Network Approach**, **Natarajan Gautam**, Pennsylvania State University, Dept. of IME, 207 Hammond Bldg., University Park, PA 16802, ngautam@psu.edu

We use closed queueing networks to model web proxy-servers and mirror sites. Performance characteristics such as throughput, delay and server utilization are obtained. These are used in an optimization problem to determine the number and location of proxy-servers in the network.

SC09 Supply Chain Management

Cluster: Inventory Management

Invited Session

Chair: Markus Ettl, IBM Research Division, TJ Watson Research Ctr., PO Box 218, Rte. 134, Yorktown Heights, NY 10598, msettl@us.ibm.com

1) **Sensitivity Analysis for a Class of (s,S) Inventory Systems**, **Sanjay E. Ramaswamy**, IBM, TJ Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, sanjayr@us.ibm.com, **Dinah Cheng**, **Yin-Tat Leung**

We provide sensitivity information about average lost sales and inventory levels of an (s,S) inventory system with respect to the 2 decision variables s and S. The sensitivity information is exact when compared to a finite-difference simulation. We show how to use this information for what-if analysis and optimization of the decision variable s and S.

2) **Key Observations of the Replenishment Best Practices Primarily in the Technology Sector**, **Mamnoon Jamil**, IBM Integrated Supply Chain, 1000 Atrium Way, Atrium 1, Mt. Laurel, NJ 08054, mamnoon@us.ibm.com, **Susan Rothberg**

We examine a number of key replenishment strategies. There is no single strategy that will transform the replenishment process into best practices. World-class companies employ multiple strategies to compete successfully. Successful replenishment strategies depend on close collaboration with suppliers. We discuss descriptions, benefits and examples for each strategy.

3) **Supply Chain Optimization in a Configure-to-Order Environment: Process Design**, **Thomas R. Ervolina**, IBM, TJ Watson Res. Ctr., PO Box 218, Yorktown Heights, NY 10598, ervolina@us.ibm.com, **Kaan Katiircioglu**

We show an end-to-end supply chain process design to support configure-to-order over the Web in real-time. We will address issues and challenges associated with supply and demand planning, product structure, allocation policies and real-time order promising.

4) **Inventory Management in an Assemble-to-Order System with Lead Time & Demand Uncertainty**, **David D. Yao**, Columbia University, IEOR Dept., 302 Mudd Bldg., New York, NY 10027-6699, yao@ieor.columbia.edu, **Feng Cheng**, **Markus Ettl**, **Grace Lin**

We consider a configure-to-order (CTO) system in which components are built-to-stock whereas end products are assembled-to-order. We focus on the inventory-service trade-off of the CTO system and on the performance gains in terms of reduced inventory cost and increased service level. Our optimization model provides an analytical tool to quantify these performance impacts.

SC10 Forecast-Adaptive Supply Chain Policies

Cluster: Production Planning & Control under Uncertainty

Invited Session

Chair: Ralph D. Badinelli, Virginia Polytechnic Institute, Dept. of MS & IT, Box 0235, Blacksburg, VA 24060, ralphb@vt.edu

1) **Quantifying the Impact of Demand Information & Forecasting on Variability & Costs in a Supply Chain**, **Jennifer K. Ryan**, Purdue University, Dept. of IE, 1287 Grissom Hall, West Lafayette, IN 47907-1287, jkryan@ecn.purdue.edu

Previous research has studied the impact of forecasting and demand information on variability in a supply chain. We briefly review some of these results. We then consider the impact of this increased variability on supply chain costs and

present a simple model which allows us to evaluate the value of demand information and forecasting in the supply chain.

2) All-or-Nothing Ordering under a Capacity Constraint & Advance Forecast Information, Guillermo Gallego, Columbia University, IEOR Dept., Mudd Bldg., 500 West 120th St., Rm. 331, New York, NY 10027, ggallego@ieor.columbia.edu, http://www.ieor.columbia.edu/~ggallego, **Beril L. Toktay**

We show that a simple policy is optimal for a capacity-constrained single-item stochastic inventory model under advance forecast information when high fixed ordering costs justify ordering at capacity or not ordering at all.

3) Reducing Supply Chain Inventory Costs through Joint Forecasting Processes, Yossi Aviv, Washington University, Olin Sch. of Bus., One Brookings Dr., CB 1133, St. Louis, MO 63130-4899, aviv@mail.olin.wustl.edu

We study supply chain inventory control when forecast information is not commonly known throughout the supply chain. We will discuss results from 2 research papers; one focuses on decentralized supply chains and the second on centralized supply chains. Our results provide insights into the benefits of collaborative planning, forecasting and replenishment programs.

4) Dynamic Policies for Forecasting Updating & Supply-Chain Control, Ralph D. Badinelli, Virginia Polytechnic Institute, Dept. of MS & IT, Box 0235, Blacksburg, VA 24060, ralphb@vt.edu

Forecast updating can introduce complex, dynamic behavior into a forecast independently of such behavior in the actual demand process. We examine the interaction of supply chain policies with the dynamics of forecast updating. Options for configuring supply chain policies to adapt to forecast updating are investigated.

SC11 Panel: Challenges & Opportunities of QSR Methods - An Industrial Perspective

**Sponsor: Quality, Statistics & Reliability
Sponsored Session**

Chair: Darek Ceglarek, University of Michigan, 1031 Dow Bldg., Dept. Mech. Eng. & App. Mech., Ann Arbor, MI 48109-2136, darek@engin.umich.edu

Co-Chair: Jan Shi, University of Michigan, Dept. of IOE, 1815 IOE, Ann Arbor, MI 48019-2117, shihang@umich.edu

1) Panel: Challenges & Opportunities of Quality, Statistical & Reliability Methods - An Industrial Perspective, Way Kuo, Texas A&M University, Dept. of IE, College Station, TX 77843, way@acs.tamu.edu, **Thomas Reynolds,** DaimlerChrysler, tr3@dcx.com, **Larry Oh,** Silicon Valley Group Inc., ohl@svg.com, **Agus Sudjianto,** Ford Motor Co.

Though QSR methods have been advanced rapidly in the last decade, there are many practical issues and challenges in implementing those methods in industry. Experts in the field are invited to address those issues that will benefit both researchers from academia and practitioners in industry.

SC12 Markov Decision Processes I

**Cluster: Dynamic Programming
Invited Session**

Chair: O. Hernandez-Lerma, CINVESTAV-IPIN, Dept. de Matematicas, A. Postal 14-470, Mexico DF, 07000, Mexico, ohermand@math.cinvestav.mx

1) withdrawn - chair request of 3/31, Alexander A. Yushkevich, University of North Carolina, Dept. of Math., Charlotte, NC 28223, aayusheke@email.uncc.edu

2) Borel-State Semi-Markov Control Models with Unbound Costs, Sample Path Average Cost Criterion, Fernando Luque-Vasquez, Universidad de Sonora, Dept. de Matematicas, Rosales, y Blvd. Luis Encinas 83000, Hermosillo, Sonora, Mexico, fluque@gauss.mat.uson.mx

we consider semi-Markov control models with Borel state- and control-spaces, unbounded cost and mean holding time. Suitable conditions are given for the existence of solutions to the average cost optimality equation, the equivalence of several cost criteria and the existence of stationary optimal policies for these criteria.

3) Blackwell Optimality in Markov Control Processes with a Borel State-Space via Nested Models, Guadalupe C. Licea, Ciudad

Universitaria, Dept. de Matematicas, Fac. de Ciencias, Mexico, DF 04510, Mexico, glc@hp.fciencias.unam.mx, **O. Hernandez-Lerma**

We use a nested sequence of Markov control models to arrive to a Blackwell optimal policy for a model with a Borel state-space, compact actions sets and unbounded costs. The assumptions include geometric ergodicity, irreducibility of the transition law and a Lyapunov-like condition over the weight function.

4) Markov Decision Processes with "Sensitive" Average Cost Criteria, O. Hernandez-Lerma, CINVESTAV-IPIN, Dept. de Matematicas, A. Postal 14-470, Mexico DF, 07000, Mexico, ohermand@math.cinvestav.mx

We discuss the connections between several "sensitive" average cost criteria for MDPs on Borel spaces with unbounded costs. These criteria include bias optimality, Flynn's opportunity cost, Dutta's criterion, (weak) overtaking optimality, strong 0-distributions, etc.

SC13 Tutorial: Combinatorial Optimization: Current Successes & Directions for the Future Invited Session

Chair: Karla Hoffman, George Mason University, School of IT & Eng., 4400 University Dr., MS 4A6, Fairfax, VA 22030, khoffman@vms1.gmu.edu

1) Tutorial: Combinatorial Optimization - Current Successes & Directions for the Future, Karla Hoffman, George Mason University, School of IT & Eng., 4400 University Dr., MS 4A6, Fairfax, VA 22030, khoffman@vms1.gmu.edu

This tutorial highlights the major breakthroughs that have allowed the solution of very large, complex combinatorial optimization problems. Model formulation, preprocessing, heuristics, cutting-plane techniques and column-generation approaches will be presented along with a description of how all of these can be combined into a meta-algorithm. We end with some very exciting new opportunities.

SC14 Optimization in Support Vector Machines

**Cluster: Engineering Optimization
Invited Session**

Chair: Theodore B. Trafalis, University of Oklahoma, Sch. of IE, 202 West Boyd, Rm. 124, Norman, OK 73019, trafalis@mailhost.ecn.ou.edu

1) Training Support Vector Machines using Interior Point Methods, Theodore B. Trafalis, University of Oklahoma, Sch. of IE, 202 West Boyd, Rm. 124, Norman, OK 73019, trafalis@mailhost.ecn.ou.edu, **Alexander Malysheff**

Training an SVM requires the solution of a very large QP optimization problem. This large QP problem is decomposed into a series of smallest QP problems. IPMs are used for the solution of the resulting QP subproblems.

2) Learning with Kernel Machines & their Ensembles, Theodoros Evgeniou, MIT, Ctr. Biological/Comp. Learning, Cambridge, MA 02139, theos@ai.mit.edu, **Massimiliano Pontil**

We present theoretical results on the generalization performance of ensembles of kernel machines, including SVM, as well as experiments supporting the theory. We discuss implications of the theory on designing learning machines and probe into finding optimization formulations of learning machines suggested by the theoretical findings.

3) Support Vector Regression, Olvi L. Mangasarian, University of Wisconsin, Comp. Sci. Dept., 1210 West Dayton St., Madison, WI 53706-1685, olvi@cs.wisc.edu, **David R. Musicant**

SVMs, widely used for classification problems, are applied here to regression problems to generate very general nonlinear surfaces for massive data fitting. Very large LPs, with as many as a billion nonzero matrix elements, are solved using column and row chunking.

SC15 Convex Optimization & Complexity Issues

Cluster: Linear Programming/Complementarity

**Sponsor: Optimization Section
Sponsored Session**

Chair: Robert M. Freund, MIT, Sloan Sch. of Mgmt., 50 Memorial Dr., Cambridge, MA 02139, rfreund@mit.edu

1) On Condition Numbers & Error Bounds for Linear Programming, Shuzhong Zhang, Chinese University of Hong Kong, Dept. of SEEM, Shatin NT Hong Kong, Hong Kong, zhang@se.cuhk.edu.hk

We discuss the relationship between the condition numbers for LP such as the

ones used by vavasis & Ye and the error bound analysis for linear systems. It is shown that the sharp Lipschitz constant in the Hoffman type error bound is precisely one of these condition numbers.

2) Measures of Conditioning for Convex Optimization, Marina A. Epelman, University of Michigan, Dept. of IOE, 1205 Beal Ave., Rm. 2793, Ann Arbor, MI 48109-2117, mepelman@umich.edu

We study measures of conditioning for convex optimization problems in conic linear form. We analyze the geometric properties of the problems and performance of algorithms for solving such systems in terms of these measures and indicate the limitations of each measure in such analyses.

3) Condition Numbers & Infeasible Convex Programs, Manuel A. Nunez, Chapman University, Argyros Sch. of Bus. & Econ., 1 University Dr., Orange, CA 92866, mnunez@chapman.edu

By using a recent characterization of the interior of the set of infeasible data instances of a convex program, we present several properties of infeasible convex programs in terms of Renegar's condition number. We use these properties to study the complexity of determining whether a data instance is infeasible.

4) Geometry & Complexity in Convex Optimization, Robert M. Freund, MIT, Sloan Sch. of Mgmt., 50 Memorial Dr., Cambridge, MA 02139, rfreund@mit.edu

Consider the problem of finding a point in a convex set S , using either an interior-point method or the ellipsoid algorithm. We present complexity results for this problem in terms of geometric characteristics of S (inscribed and circumscribed balls), as opposed to condition-numbers.

SC16 Real-Time Transportation Systems I

Sponsor: Transportation Science Section

Sponsored Session

Chair: Pitu B. Mirchandani, University of Arizona, Dept. of SIE, ENGR 111c, Tucson, AZ 85721, pitu@sie.arizona.edu

1) A Classification Framework for Off-Line, On-Line & Real-Time Systems, Pitu B. Mirchandani, University of Arizona, Dept. of SIE, ENGR 111c, Tucson, AZ 85721, pitu@sie.arizona.edu

With the introduction of ITS computation/communication/control technologies in the operation of transportation systems, especially the communication pipes from the field to the decision/control functions, the number of on-line decision/control actions increase dramatically. We introduce a framework to distinguish among off-line, on-line and real-time decision and control systems.

2) Real-Time Turning Proportions Estimation for Adaptive Signal Control, Steve Nobe, University of Arizona, Tucson, AZ 85721

We present a computationally fast technique to estimate turning proportions at intersections and off-ramps. A rolling horizon with short time intervals is used. Data collected from major intersections in Tucson, Arizona and Interstate 10 in Phoenix, Arizona were used to test the method.

3) RHODES-dot-edu: An Approach for Pre-Testing a Real-Time Traffic Control Strategy, David E. Lucas, University of Arizona, SIE Dept., Tucson, AZ 85721, lucas@sie.arizona.edu, **Pitu B. Mirchandani**

A new enhancement to standard software-only simulation is described that allows for remote access, removing the requirements that both the simulation and traffic control software reside locally. This system will create additional evaluation opportunities for agencies interested in deploying RHODES as well as increased collaboration with other researchers.

SC17 Recent Advances in Microscopic Traffic Simulation I

Cluster: Microscopic Traffic Simulation

Invited Session

Chair: Jaime Barcelo, Universitat Politecnica De Catalunya, Dept. of Stats. & OR, Pau Gargallo 5, Barcelona, 08028, Spain, jaume.barcelo@upc.es

1) Towards a Hybrid Macro-Micro Traffic Flow Simulation Model, Laurent Magne, ONERA Centre de Toulouse, 2 Ave. Edouard Belin, BP 4025, Toulouse Cedex, 31055, France, laurent.magne@cert.fr, **Sylvestre Rabut, Jean-Francois Gabard**

We will present recent advances in the development of a new traffic flow simulation concept which consists of jointly using a macroscopic model and a microscopic model. This approach enables modeling a large network at the macroscopic level while selected parts can be detailed at the microscopic level...

2) Towards an Agent-Based Approach to Microscopic Traffic Simulations, Georg Hertkorn, German Aerospace Center DLR,

Koeln, D-51147, Germany, georg.hertkorn@dlr.de, **Stephan Rosswog, Peter Wagner**

Much progress has been made in modeling traffic microscopically by using minimalistic approaches. However, there are still a number of unexplained features in human driving behavior and empirical observations of traffic flow. We present recent work that aims to combine minimalistic modeling approaches with multi-agent-based simulation techniques. The agents play traffic games to optimize their performance (travel times).

3) Real-Time Microsimulation of Urban Traffic, Iisakki Kosonen, Helsinki University of Technology, Transport. Eng., PO Box 2100, Hut, FIN 02015, Finland, iisakki.kosonen@hut.fi, **Andrzej Bargiela**

We present results of the feasibility study of real-time microscopic simulation of urban traffic, using the HUTSIM microsimulator, which has been modified to accept the real-time telemetry data provided by the urban traffic control system (SCOOT). The motivation was the desire to overcome the limitation of the off-line traffic simulators for which instantaneous results rarely, if ever, match those observed in real life...

SC18 In-Class Experiences with Cases from the Wiley/INFORMS Teaching Materials Initiative

Sponsor: INFORM-ED

Sponsored Session

Chair: Susan W. Palocsay, James Madison University, CIS/OM Program, MSC 0202, Harrisonburg, VA 22807, palocssw@jmu.edu

1) Wiley/INFORMS LP Cases: A First Encounter, Susan W. Palocsay, James Madison University, CIS/OM Program, MSC 0202, Harrisonburg, VA 22807, palocssw@jmu.edu

To give students in my MS course a taste of the real world, I adopted 2 of the new Wiley/INFORMS LP cases this year. I will describe a structured approach, where students are provided a verbal description of the model and a spreadsheet template to facilitate their use by sophomores.

2) The Role of Strategic OR/MS Cases, Thomas A. Grossman, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, grossman@ucalgary.ca

OR/MS courses generally have a strong decision orientation. It can be beneficial to include content on the use of OR/MS in the business world. Strategic OR/MS cases can prepare OR students for the world of practice and can show business students how OR/MS techniques are central to important strategic initiatives.

SC19 Telecommunications I

Contributed Session

Chair: Dennis C. Dietz, US WEST Advanced Technologies, 4001 Discovery Dr., Boulder, CO 80303, dxdiet2@uswest.com

1) Regulation & Competition in the Local Loop, Kostis Christodoulou, London Business School, 5 Tarranbrae, Willesden Ln, London, NW6 7PL, UK, kchristodoulou@lbs.ac.uk, **Kiriakos Vlahos**

We discuss the consequences of regulation in the local loop. We consider a simulation model, discuss its adequacy in capturing interactions in the marketplace and use it to examine alternative regulatory policies and their effect on promoting firm entry, investment and competition in the local loop.

2) Planning Models for Wide-Area Communication Network Design with Response-Time Dependent Offered Traffic, Larry J. LeBlanc, Vanderbilt University, Owen Grad. Sch. of Mgmt., 401 21st Ave. South, Nashville, TN 37203-9865, larry.leblanc@owen.vanderbilt.edu, **Sridhar Narasimhan, Bin Ran**

Given a network topology and capacities, we determine how much potential traffic can be accommodated. We present models which recognize that some but not all users will tolerate delays. To do this, we develop routing models for different situations with response-time-dependent offered traffic. Computational results are given.

3) Optimal Redesign Models for Communication Networks, Gyunghyun Choi, Hanyang University, Dept. of IE, 17 Haengdang-Dong Seongdong-gu, Seoul, 133-791, Korea, ghchoi@email.hanyang.ac.kr, **Ho-mahn Kwak**

The rapid change of communication network management has created several redesign problems such as capacity expansion and route change. We present such integrated models as well as specially designed large-scale optimization algorithms.

4) A General Model for ATM Network Planning, Dennis C.

Dietz, US WEST Advanced Technologies, 4001 Discovery Dr., Boulder, CO 80303, dxdiet2@uswest.com, *Amie Elcan*, *Daphne Skipper*

We develop an MIP model that specifies an optimal configuration for a metropolitan telecommunication network. The model determines the optimal placement of ATM core switch hardware and fiber optic transport. The objective is to satisfy point-to-point traffic demand at minimum cost while ensuring specified performance under a core failure contingency.

SC20 Knowledge Management & Sharing

Sponsor: College on Artificial Intelligence

Sponsored Session

Chair: Roman Wong, California State University, Dept. of Acct. & MIS, 18111 Nordhoff St., Northridge, CA 91330-8372, roman.wong@csun.edu

1) Validation of KBS Design at the Logical Level, *Roman Wong*, California State University, Dept. of Acct. & MIS, 18111 Nordhoff St., Northridge, CA 91330-8372, roman.wong@csun.edu

The task-structure approach emphasizes the explication of the problem-solving role played by each knowledge primitive required for a given task, hence, facilitates a knowledge-base to be developed in progressive stages. We examine whether the knowledge bases produced at multiple stages facilitate the validation of KBS design at the logical level.

2) Interorganization Information Sharing: A Cooperative, *Kristina Setzekorn*, Oakland University, Rochester Hills, MI 48309, setzekor@oakland.edu

The Shapley value is the sum (over all potential coalitions) of a player's contribution to each potential coalition, multiplied by his/her probability of being included in that coalition. Shapley values can be applied to predict/prescribe inter-organizational knowledge-sharing. They can predict what information a firm should share and with whom.

3) Deconstructing Tacit Knowledge, *James Eynon*, Wake Forest University, Calloway Sch. Bus. & Account., PO Box 7285 Reynolds Station, Winston-Salem, NC 27109-7285, eynonj@wfu.edu

Tacit knowledge has become an umbrella term for several phenomena that are arguably distinct from each other. It is argued that this ambiguity of meaning has some unfortunate consequences for the management and IS disciplines. We explore alternative meanings of tacit knowledge and the research implications of each.

4) Knowledge-Based Retrieval & Transformation of GIS Data Distributed on the Internet, *Raja Sengupta*, University of Iowa, Dept. of Geography, 316 Jessup Hall, Iowa City, IA 52242, raja-sengupta@uiowa.edu

Large amounts of GIS data are being made available on the Internet. Currently, "spatial metadata" are being used to search for GIS data. However, data retrieved in the original format requires transformations peculiar to geographic data, e.g., map projections. Blackboard architecture can be used to create a "software agent" that converts downloaded data into a common, interoperable format.

SC21 Simulation I

Contributed Session

Chair: Robert M. Saltzman, San Francisco State University, 1600 Holloway Ave., Coll. of Bus., San Francisco, CA 94132-1722, saltzman@sfsu.edu

1) withdrawn - duplicate presentation, *Kendra E. Moore*, ALPHATECH, Inc., 50 Mall Rd., Burlington, MA 01803, kem@alphatech.com, *Jack C. Chiang*, *Scott Hammer*

2) Determining a Layout for the Order Picking Area in Warehouses, *Kees Jan Roodbergen*, Rotterdam School of Management, PO Box 1738, Rotterdam, 3000 DR, The Netherlands, k.roodbergen@fbk.eur.nl

We give 2 methods to determine aisle length, the number of aisles and the number of cross aisles for an order picking area. One method is a search procedure that uses simulation to determine route length. The other uses statistical properties of a frequently used routing method.

3) A Simulation Approach to Dynamic Modeling of Supply Chain Design Strategies, *Hulya Yazici*, University of Wisconsin, 418G North Hall, 1725 State St., La Crosse, WI 64601, yazici.hulya@uwlax.edu, <http://www.perth.uwlax.edu/faculty/yazici>

Understanding the dynamics and complexities of supply chains is a major challenge for today's global business. A pragmatic approach is needed to generate and evaluate supply chain strategies. We present the simulation

approach taken to study the influence of market, technology and process-driven strategic factors on supply chain efficiency.

4) Enhancing Competitiveness of the Customer Loan Center at B. T. Financial Group, *Prakash Mirchandani*, University of Pittsburgh, Katz Grad. School of Bus., 224 Mervis Hall, Pittsburgh, PA 15260, pmirchan@mail.business.pitt.edu, *G. G. Hegde*, *Richard E. Wendell*

Competition for selling loans is fierce with a bank's response time being an important factor in its winning the loan. We determined the relationship between response time and staffing levels, and in the course, also identified a number of other important insights and recommendations that led to significant process improvements.

5) Decision Support for a Strategic Call Center Business Planning Problem using Simulation, *Robert M. Saltzman*, San Francisco State University, 1600 Holloway Ave., Coll. of Bus., San Francisco, CA 94132-1722, saltzman@sfsu.edu, *Vijay Mehrotra*

Rapid simulation modeling of call center operations played a critical role in launching a new revenue-generating technical support program introduced by a large software company. We describe how our animated simulation model was quickly developed and analyzed to answer capacity planning questions that queuing equations could not readily address.

SC22 Organizational Management

Contributed Session

Chair: Amy Kallianpur, Michigan State University, N302 NBC, Broad Sch. of Mgmt., East Lansing, MI 48824, amy.kallianpur.wp99@wharton.upenn.edu

1) Information Technology, Globalization & the Search for Competitive Advantage, *L. L. Jayaraman*, Montclair State University, Dept. of Mgmt., School of Bus., PA 433, Upper Montclair, NJ 07043, jayaramanl@mail.montclair.edu

The role of IT in the pursuit of operational economies is better understood compared to strategic positioning in the competitive space. Globalization introduces a new order of complexity with opportunities, risks and challenges. We explore the role of IT as the "new capital" to be harnessed for growth and profit.

2) Reengineering the Corporate Financial Function, *David C. Ho*, Ryerson Polytechnic University, Sch. of IT Mgmt., 350 Victoria St., Toronto, Ontario, M5B 2K3, Canada, dho@acs.ryerson.ca, *David Hui*

We describe the opportunities, issues and challenges of reengineering the financial function drawing on the experience of Ontario Hydro, one of the largest electric utilities in North America. Process re-design, conflict resolution and change management aspects will be discussed.

3) Designing the Organizational Structure under Transition Economy, *Alexey E. Bazhanov*, Kharkov State Economic University, 16 Novgordskay, ap. 54, Kharkov, 310145, Ukraine, abbaz@mail.ru

In the Ukraine, existing traditional normative approaches for designing the organizational structure of enterprises based on the simplified models and regulation of functions do not allow deciding problems of adaptation of management systems and organizational structures of the enterprises to the changeable market environment. It defines necessity of development of new methods of the organizational structure design...

4) Toward a Definition of Research, *William W. Damon*, Vanderbilt University, Box 6069, Station B, Nashville, TN 37235, william.w.damon@vanderbilt.edu

Today's research universities have the dual missions of creating and disseminating knowledge. These institutions face competition in both tertiary education and research. Justification of the research university requires a consideration of whether research and teaching are complements or substitutes. We develop the requisite working definition of research.

5) Predatory Pricing: We Searched & Found It, *Amy Kallianpur*, Michigan State University, N302 NBC, Broad Sch. of Mgmt., East Lansing, MI 48824, amy.kallianpur.wp99@wharton.upenn.edu

It is generally agreed that predatory pricing is rare. In fact, researchers have characterized the issue as being whether predation is rare like an old stamp or rare like the unicorn. We design economic structures generally unfavorable to predation and yet observe clear instances of predatory behavior.

SC23 Sustainable Cities for the 21st Century: Rethinking the Problem

Cluster: Non-Traditional OR
Invited Session

Chair: Ellis L. Johnson, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, ejohnson@isye.gatech.edu

1) Perfect Fertilizer from Urban Wastewater Infrastructures: Design for a Future with "Silk Purses out of Sows' Ears", *M. Bruce Beck*

The purpose of an urban wastewater infrastructure is generally considered to produce a sparkling liquid product, from which a bothersome solid by-product must be removed and disposed of elsewhere. Our goal is to conceive of an infrastructure whose purpose is to produce an ideal solids product, the "perfect fertilizer..."

2) Zero Regulation: Anarchy or Sustainability?, *Michael E. Chang*

Legislated laws, rules and regulations instill order in otherwise complex human settlements. One may argue that without these rules, chaos and anarchy would prevail. One could also argue however, that in a truly sustainable community, laws governing consumption of resources or production of wastes are simply not needed. In this latter context, "good" urban evolution leads to less regulation, not more...

3) Evaluating Emerging Technologies for a Sustainable City, *Victoria C.P. Chen*, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, *Michael E. Chang*, *M. Bruce Beck*, *Jining Chen*, *Ellis L. Johnson*

In order to design a sustainable city for the 21st century, a method for evaluating the possibilities must be developed. This decision-making framework may be used to explore hypothetical paradigms on various scales, subject to technical and societal constraints and to measure their effect on other internal and external systems. This includes the ability to evaluate databases of emerging technologies...

SC24 Extensions of DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Lawrence M. Seiford, University of Massachusetts, Dept. of MIE, Amherst, MA 01003, seiford@ecs.umass.edu

1) Trade Restrictiveness & Efficiency, *Rolf Fare*, Oregon State University, Dept. of Economics, Corvallis, OR 97331, rolf.fare@orst.edu, *Shawna P. Grosskopf*

We build on a sequence of papers by Anderson and Neary on index measurement of trade restrictiveness based on distance functions in price space. We introduce a "dual" version of their index, which scales output quantities. The proposed trade restrictiveness quantity index embodies 2 Farrell measures of efficiency, one each for the producers and the consumers...

2) Components of Malmquist Productivity Assessment, *Yao Chen*, University of Massachusetts, Isenberg Sch. of Mgmt., Amherst, MA 01003, yao@som.umass.edu, *Agha Iqbal Ali*

Malmquist productivity assessment is based on mixed and single period measures. We examine these constituent calculations to reveal patterns of productivity change that are obscured by the aggregated nature of Malmquist type indexes.

3) Allocative Efficiency in DEA, *Joe Zhu*, Worcester Polytechnic Institute, Dept. of Mgmt., 100 Institute Rd., Worcester, MA 01609, jzhu@wpi.edu, *Lawrence M. Seiford*

We discuss alternative ways to estimate allocative efficiency in DEA when exact price information is not available. Hypothesis testing is used to test for accuracy.

SC25 Information Systems I

Contributed Session

Chair: Charles C. Hinnant, University of Georgia, Dept. of Political Sci., 104 Baldwin Hall, Athens, GA 30602-1615, chinnant@arches.uga.edu

1) Formalization & Verification of Structural Workflow Processes, *Yongjie Ren*, Chinese University of Hong Kong, Dept. of SE & EM, Hong Kong, PRC, ygren@se.cuhk.edu.hk

An agent-based workflow model is formalized using process algebra. With the restriction of the model to structural workflow processes, we propose a simple algorithm which can verify the safeness of workflow processes in polynomial

time.

2) **withdrawn** - author request of 3/15, *Dan Zhu*, Iowa State University, 300 Carver Hall, Ames, IA 50011, dzhu@iastate.edu

3) **Creating & Sharing Knowledge using Web-Based Planning Models**, *Paul R. Bunch*, Eli Lilly & Company, Lilly Corporate Ctr., Indianapolis, IN 46285, bunch@lilly.com

Several case studies from R&D planning will be shared which describe how we have incorporated system dynamics models into Web-based learning environments. Focus will be given to how the models were used to create and share knowledge about the planning process to user groups.

4) **Gaining Consumer Insights from Automated Textual Data Analysis**, *Kuang C. Wei*, Ford Motor Company, 2101 Village Rd., MD 2122, SRL Bldg., Dearborn, MI 48124, kwei@ford.com, *Barbara I. Nance*, *Gint V. Puskorius*

An Internet-based method of gaining consumer insights on products was developed. An open-ended product survey was conducted on the Internet. Verbatim responses (textual data) were analyzed and presented on a multi-dimensional space for easy visualization. Theme maps highlight clusters of desirable features, key concerns and technology issues most related to consumers.

5) **Controlling Information Resources: Social & Technical Determinants in Public Organizations**, *Charles C. Hinnant*, University of Georgia, Dept. of Political Sci., 104 Baldwin Hall, Athens, GA 30602-1615, chinnant@arches.uga.edu

We present and discuss a theory administrative control for government information assets. The theory posits that the level and form of administrative controls employed by public organizations to management information are a function of social and technical factors arising from the internal and external environment...

SC26 Advanced Topics in Project Scheduling

Cluster: Advanced Topics in Project Scheduling

Invited Session

Chair: Erik L. Demeulemeester, Katholieke Universiteit Leuven, Op. Mgmt. Group, Naamsestraat 69, Leuven, B-3000, Belgium, erik.demeulemeester@econ.kuleuven.ac.be

1) A Recursive Procedure to Represent an Activity Network in a Unique Fashion, *Mario Vanhoucke*, Katholieke Universiteit Leuven, Op. Mgmt. Group, Naamsestraat 69, Leuven, 3000, Belgium, mario.vanhoucke@econ.kuleuven.ac.be, *Erik L. Demeulemeester*, *Willy S. Herroelen*

We describe a recursive procedure to represent activity networks in a unique fashion. This procedure implicitly enumerates all possible representations of a network with a given topological structure. We assign a weight to each node of the network in order to rank these nodes according to a specific criteria.

2) **Project Planning & Replanning**, *Kevin M. Calhoun*, Air Force Institute of Technology, AFIT/ENS, 2950 P St., WPAFB, OH 45433, kevin.calhoun@afit.af.mil, *Richard F. Deckro*, *James T. Moore*, *James W. Chrissis*, *John C. Van Hove*

An approach is developed to find good solutions for an initial project schedule that includes activity priorities. The technique is adapted to generate replanning options. Replanning is a key operational problem. The approach developed here can be modified for use in any enterprise where replanning is common.

3) **Genetic Algorithms for Project Scheduling: New Crossover Techniques**, *Concepcion Maroto*, Universidad Politecnica de Valencia, Dept. of Stats. & OR, Camino de Vera s/n, Valencia, 46071, Spain, cmaroto@eio.upv.es, *Javier Alcaraz*

GAs are one of the most promising metaheuristics. We have developed 2 new crossover techniques for solving the resource-constrained project scheduling problem. They use a new solution encoding, based in activity list, taking into account the scheduling method (forward/backward). The new operators permit to design a robust GA that outperforms the published metaheuristics.

4) **A Taxonomy of Project Management Based on Operations Priorities**, *M. J. Oltra*, Jaume I University, Bus. Mgmt. & Mktg. Dept., Castellon, 12080, Spain, oltra@emp.uji.es, *Concepcion Maroto*, *Baldomero Segura*

We define a project management taxonomy based on operations strategy priorities. The information used was gathered from a survey carried out in Spanish firms from several industries. The types of project management are characterized by the projects and the operations management policies and tasks. We pretend to link project management with the operations strategy context.

SC27 Pricing & Revenue Management I**Cluster:** Pricing & Revenue Management**Invited Session****Chair:** Georgia Perakis, MIT, Sloan Sch., E53-359, 1 Amherst St., Cambridge, MA 02139, georgiap@mit.edu

1) **Towards Integrating Overbooking & Fare Class Allocation at the Network Level**, *Garrett J. van Ryzin*, Columbia University, 412 Uris Hall, Grad. School of Bus., New York, NY 10027, gjv1@columbia.edu, *Itir Z. Karaesmen*

We discuss one approach for integrating both overbooking limits and fare class allocations at the network (O&D) level. The approach requires some simplifying approximations but captures interesting dependencies between overbooking limits and network bid prices.

2) **Yield Management in the Supply Chain**, *Jeffrey I. McGill*, Queen's University, Sch. of Business, Kingston, Ontario, K7L 3N6, Canada, jmcgill@business.queensu.ca, *James H. Bookbinder*

We discuss the application of yield management perspectives to shipment consolidation and other supply chain issues.

3) **Dynamic Pricing in a Competitive Environment**, *Georgia Perakis*, MIT, Sloan Sch., E53-359, 1 Amherst St., Cambridge, MA 02139, georgiap@mit.edu, *Dimitris Bertsimas*, *Marc Coumeri*

We present an optimization approach for pricing in an oligopoly environment. The key contribution of our approach is an optimization model for learning the demand and setting prices for parametric families of demand functions. We present our model and some numerical results in airline ticket pricing.

SC28 Location Models I**Sponsor:** Society of Location Analysis**Sponsored Session****Chair:** Trevor S. Hale, Ohio University, Dept. of IMSE, Athens, OH 45701-2979, thale@bobcat.ent.ohiou.edu

1) **On Spherical Minimax Location**, *Minnie H. Patel*, University of Wisconsin, Dept. of IME, Milwaukee, WI 53201, npatel@uwm.edu

Classic methods for locating a minimax point on a sphere will be reviewed. While classic optimization methods rely on the spherical norm, more recent methods use the Euclidean norm. We will present these methods with illustrations and discussions. Extensions to the weighted spherical minimax problem will be discussed.

2) **Assessing the Impacts of Transportation Congestion using Dynamic Space-Time Accessibility Measures**, *Harvey J. Miller*, University of Utah, Dept. of Geography, Salt Lake City, UT 84112, harvey.miller@geog.utah.edu, *Yi-Hwa Wu*

Transportation networks are becoming increasingly saturated in many parts of the world. Sensitive transportation management requires improved measurement of congestion impacts on individuals. We develop dynamic space-time accessibility measures, extending network-based measures to the case where network travel times vary with flow. Computational versions use a discrete-time dynamic congestion model.

3) **Location/Allocation/Routing for Home-Delivered Meals Provision: Models & Solution Approaches**, *Michael P. Johnson*, Carnegie Mellon University, Heinz Sch. of PP&M, Hamburg Hall, Rm. 2108A, Pittsburgh, PA 15213-3890, johnson2@andrew.cmu.edu, *Wilpen L. Gorr*

Home-delivered meals provision is a volunteer-staffed activity for which little strategic planning is done. We present an HDM planning model that addresses facility location, allocation of demand to facilities and design of delivery routes. Variations of this model address kitchen location with and without existing facilities.

4) **On the Planar k-Centrum Single Facility Location Problem with Euclidean Distances**, *Guirong Liu*, Ohio University, Dept. of Mathematics, Athens, OH 45701-2979, gliu@prime.cs.ohiou.edu, *Trevor S. Hale*

The planar k-centrum location problem is addressed. We show that when k is equal to 2 (or, in some case, 3), the problem is equivalent to the planar minimax location problem. When k equals n, the problem becomes the Weber problem. We also present a new graphical solution methodology.

SC29 Applications of Risk & Reliability**Contributed Session****Chair:** Elisabeth M. Pate-Cornell, Stanford University, Dept. of MS & Eng., Terman Bldg., Rm. 348, Stanford, CA 94305, mep@leland.stanford.edu

1) **Bayesian Analysis & Adaptive Testing Strategies for Software with an Operational Profile**, *Refik Soyer*, George Washington University, Monroe Hall 403, MS Dept., 2115 G St. NW, Washington, DC 20052

We consider a software reliability model where the failure rate of each fault depends on the specific operation performed and present a Bayesian analysis of the model. Our analysis relies on the Markov chain Monte Carlo methods and is used for developing optimal testing strategies in an adaptive manner. We illustrate an implementation of our approach with simulated failure data.

2) **Testing of Software with an Operational Profile**, *Suleyman Ozekici*, George Washington University, Washington, DC 20052

We present a new model for optimal software testing when testing is performed sequentially using a set of test cases. The model parameters, consisting of testing costs and failure rates, all depend on the cases used and operations performed. Our aim is to find the optimal testing durations. This problem leads to an NLP formulation that has an explicit analytical solution under reasonable assumptions.

3) **Reliability Data Analysis Based on Operating Conditions**, *Jongwoon Kim*, Pusan National University, Dept. of IE, 30 Changjeon-Dong, Kumjeong-ku, Pusan, 609-735, Korea, k2289@chollian.net, *Wonyoung Yun*

Field data and expert opinions were used to predict failure distribution based on a specific operating condition in some existing researches. We propose a methodology for parameter estimation not only with field data and expert opinions but also with laboratory data.

4) **Reliability Analysis of a Repairable Consecutive-k-out-of-n:F System with (k-1) Step Markov Dependence**, *Wonyoung Yun*, Pusan National University, Dept. of IE, 30 Changjeon-Dong, Kumjeong-ku, Pusan, 609-735, Korea, wongyun@hyowon.pusan.ac.kr, *Gue Rae Kim*

A consecutive-k-out-of-n:F system is an ordered sequence of n components such that the system fails if and only if at least k consecutive components have failed. A model for a linear repairable consecutive-k-out-of-n:F system with (k-1) step Markov dependence is provided using a semi-Markov process. Some reliability indices are evaluated.

5) **Advanced Programmatic Risk Analysis for Interdependent Engineering Projects**, *Elisabeth M. Pate-Cornell*, Stanford University, Dept. of MS & Eng., Terman Bldg., Rm. 348, Stanford, CA 94305, mep@leland.stanford.edu, *Robin Dillon*

APRA is designed to guide management decisions involving tradeoffs between technical and management failure risks. It includes a probabilistic risk analysis and a Karush-Kuhn-Tucker optimization algorithm to minimize the probability of system failure and a set of decision trees to optimize the response to scenarios of development problems. We illustrate the model using the case of a space program.

SC30 New Advances in Production Planning & Scheduling**Sponsor:** MSOM**Sponsored Session****Chair:** Valerie Tardif, University of Texas, Dept. of Mech. Eng., Austin, TX 78712-1063, vtardif@mail.utexas.edu

1) **Master Scheduling with Changeover Times using Capacitated MRP in a Pull Production Environment**, *Mark L. Spearman*, University of Alabama, Dept. of MS & Stats., Tuscaloosa, AL 35487-0226, harley@isye.gatech.edu

We consider a polynomial approximate algorithm that computes lot sizes that minimize flow time and then uses these to check the feasibility of a given master production schedule. The result is a procedure that is fast enough to be used in real time in an "available to promise" function.

2) **Reexamining Push vs. Pull: Sometimes Push is Better**, *Ananth Krishnamurthy*, University of Wisconsin, Ctr. for Quick Response Mfg., 1513 University Ave., Madison, WI 53706-1572, akrishna@cae.wisc.edu, *Rajan Suri*

In the past decade, much has been written about the advantages of kanban and pull strategies over traditional push methods. We show that in certain multi-product and variable demand scenarios, a push strategy may actually outperform pull in terms of throughput achieved for a given WIP level.

3) **A Bayesian Model for Cycle Time Prediction**, *Christina Y. Chen*, Motorola, 3501 Ed Bluestein Blvd., MS K-31, Austin, TX 78712, ra6266@email.sps.mot.com

We present analytical expressions for the cycle time mean and variance of a closed production line with parallel exponential servers. In addition, we show how the insights gained from the analytical results are used to model and understand the scheduling of a realistic production line.

4) A Simple Procedure for Capacity Analysis within MRP, Valerie Tardif, University of Texas, Dept. of Mech. Eng., Austin, TX 78712-1063, vtardif@mail.utexas.edu

Production planners need a system that performs material requirements planning and detailed finite capacity analysis. We present an aggregation/disaggregation heuristic which determines good schedules or identifies infeasibilities when no feasible plans exist and present improvements to the disaggregation allowing a more global view of the WIP.

SC31 Supply Chain Modeling

Sponsored Session

Chair: Ram Akella, Stanford University, Dept. of EES & OR, Terman Engineering Ctr. 311, Stanford, CA 94305-4023, akella@leland.stanford.edu

1) Design Capacity Management & Time Responsiveness for Internet-Based Technological Supply Chains, Kristin Fridgeirsdottir, Stanford University, Dept. of EES & OR, Terman Engineering Ctr. 311, Stanford, CA 94305-4023, krisfrid@stanford.edu, **Ram Akella**

The design factory, with its product development activities, is an important opportunity for time-to-market improvements that has not been as extensively explored as manufacturing. We develop resource allocation models for the design factory that enhance time-to-market. The models differentiate between different types of engineering resources and incorporate queuing effects in the design factory...

2) Competition & Coordination in a Capacitated/Price Setting Supply Chain, Qing Li, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, qing.li@commerce.ubc.ca, **Derek Atkins**

In a supply chain where the manufacturer is responsible for building production capacity and the retailer is responsible for pricing, double marginalization as well as the retailer's unwillingness to manage the demand uncertainty lead to incentive incompatibility. We study contracts that allow the supply chain to align incentives.

3) Impact of Capacity, Subcontracting & Inventory on Supply Chain Time Responsiveness, Victor Araman, Stanford University, Terman Engineering Ctr., Stanford, CA 94305, varaman@stanford.edu, **Ram Akella**

A major supply chain challenge for a company in a competitive market is to significantly enhance its time-responsiveness to customers. This can be achieved by either increasing their inventory level, investing in internal capacity or by subcontracting. We develop models that capture the different options, allowing us to identify the optimal decision...

SC32 Tutorial: Constraint Programming from an OR Perspective

Sponsor: Computing Society
Sponsored Session

Chair: Neale Hirsh, Bell Atlantic, 13100 Columbia Pike, MS A-31, Silver Spring, MD 20904, neale.s.hirsh@bellatlantic.com

1) Tutorial: Constraint Programming from an OR Perspective, Greger Ottosson, Uppsala University, IT & Comp. Sci. Dept., PO Box 311, Uppsala, 751 05, Sweden, greger@csd.uu.se, <http://www.csd.uu.se/~greger/>

Constraint programming is a field whose techniques for combinatorial optimization are complementary to those of OR. Whereas integer programming focuses on relaxations, constraint programming mainly uses inference in the form of constraint propagation to reduce search. This has evolved into an art of capturing sub-structures in problems and exploiting these characteristics through specific algorithms for inference...

SC33 Preference Modeling

Cluster: Choice Engineering
Invited Session

Chair: Jan-Peter Lechner, Universitat der Bundeswehr Hamburg, FB Wirtschaftswissenschaften, Hamburg, 22039, Germany, jpl@unibw-hamburg.de

1) What's Wrong with the AHP, Jonathan Barzilai, Dalhousie

University, Dept. of IE, PO Box 1000, Halifax, Nova Scotia, B3J 2X4, Canada, barzilai@tuns.ca

We will present recent research into decision and measurement theory which among other things, provides conclusive mathematical proof that the AHP is based on errors and is not a valid methodology. These errors can be traced back to Miller's work in the mid-sixties.

2) An Introduction to Preference Function Modeling, Jonathan Barzilai, Dalhousie University, Dept. of IE, PO Box 1000, Halifax, Nova Scotia, B3J 2X4, Canada, barzilai@tuns.ca

PFM is a new, intuitive, easy-to-use but powerful decision methodology based on a rigorous mathematical theory. We will introduce the basic concepts and theory underlying PFM.

3) Software for Applying Preference Function Modeling, Ernst Grundke, Dalhousie University, Dept. of IE, PO Box 1000, Halifax, Nova Scotia, B3J 2X4, Canada

We will demonstrate Trillium/PFM, a software package which implements PFM. PFM is a new multicriteria/multiattribute decision methodology based on solid measurement theoretical foundations. Trillium is easy to use as it combines a GUI with a flexible spreadsheet-like paradigm.

SC34 Military Applications I

Contributed Session

Chair: James Bradley, US Department of State, VC/TA 2201 C St. NW, Washington, DC 20520, bradleyj@acda.gov

1) A Visual Simulation of Size Reducing Radioactive Gloveboxes, Adam W. Smith, Colorado School of Mines, 6775 West 84th Cir., No. 77, Arvada, CO 80003, knuckles@ecentral.com

The DOE is deactivating a former nuclear weapons facility, which involves risks for the workers and the environment. To reduce radiation exposure, a remote operation size reduction system (ROSRS) will use robotics and plasma arc cutting. Visual simulation of the removal, preparation and dismantling of gloveboxes is used to design the ROSRS.

2) Common Mode Failures & System Effectiveness, Robert Batcher, US Department of State, VC/TA 2201 C St. NW, Washington, DC 20520, batchero@acda.gov, **James Bradley**

CMF may degrade the effectiveness of weapons systems that attach targets with salvos of gun rounds or missile intercepts. We examine several models of CMF and compare them to models used in the nuclear power industry. We also examine the implications of CMF for military system performance criteria.

3) Site Selection for Chemical & Biological Weapons Inspection, James Bradley, US Department of State, VC/TA 2201 C St. NW, Washington, DC 20520, bradleyj@acda.gov, **Robert Batcher**

Treaties to eliminate chemical and biological weapons typically provide for on-site inspections. Several protocols for selecting inspection sites have been advanced. We compare these protocols using measures of their ability to deter treaty violations.

SC35 Software Demonstration I

Software Demo Session

Chair: To be announced

1) Maximal Software, Inc.: Using the MPL Optimax 2000 Component Library with VBA for Excel & Visual Basic, Bjarni Kristjansson, Maximal Software Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201, bjarni@maximal-usa.com, www.maximal-usa.com

The OptiMax 2000 is a highly anticipated Component Library (API) designed to take full advantage of the ActiveX Automation component software technologies from Microsoft. Using step-by-step examples, we will demonstrate how to use the OptiMax 2000 to seamlessly integrate MPL into VBA for Excel/Access, Visual Basic, Visual C++, Delphi, Java and the Web, thus, easily creating customized end-user applications to solve real-world optimization problems.

Sunday 15:00-16:30

SD01 Strategy Implementation & Decision Analysis

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Mark Brodfuehrer, General Motors, Design Ctr., MC 480-113-A31, 30100 Mound Rd., PO Box 9030, Warren, MI 48090-9030, mark.brodfuehrer@gm.com

Co-Chair: Brian Hagen, Navigant Consulting Inc., 2440 Sand Hill Rd., Menlo Park, CA 94025-6900, bhagen@sdg.com

1) Including Implementation Uncertainty in Decision Analysis, Brian Hagen, Navigant Consulting Inc., 2440 Sand Hill Rd., Menlo Park, CA 94025-6900, bhagen@sdg.com, **Mark Brodfuehrer**

Practicing decision analysts often downplay the issues of implementation during the framing and evaluation stages of a decision. Underestimation of what it takes to successfully implement a decision can bias an analysis to the point of making the wrong recommendation. We provide a simple example and discussion of including implementation uncertainty in decision analyses.

2) Applying Decision Tools when Implementing Strategy in a Union Environment, Peter J. McAliney, Chenery & Co., 1070 Foster St., Franklin Square, NY 11010, peter_mcaliney@baruch.cuny.edu

Language for decision framing and describing decision tools is technically sophisticated. Conversations within organizations usually involve highly educated senior managers. However, effective implementation with unions often causes leadership and membership to diverge. Decision practitioners therefore must also communicate powerful decision concepts to valued stakeholder groups unfamiliar with the supporting theories.

3) Putting People into Managing for Value, Robert W. Lawler, Boeing, 17513 155th Ave. SE, Renton, WA 98058, robert.w.lawler@boeing.com

Improving the way we manage the enterprise, our people and our intellectual capital is essential for achieving full shareholder value. We describe the 3 components and develop a value engine that provides a frame for integrated strategy development and implementation.

4) The Transition from Decision to Implementation, Mark Brodfuehrer, General Motors, Design Ctr., MC 480-113-A31, 30100 Mound Rd., PO Box 9030, Warren, MI 48090-9030, mark.brodfuehrer@gm.com, **Brian Hagen**

One of the most disappointing events for a practicing decision analyst is doing an excellent job in aligning the individuals of a corporation to a specific decision only to find several months later that the implementation of the decision has unraveled. We explore recommendations and experience regarding the successful transition from decision to implementation.

SD02 Decision Analysis

Contributed Session

Chair: Lisa A. Zidek, University of Wisconsin, 7400 S North Cape Rd., Franklin, WI 53132, zidek@msoe.edu

1) The Best Choice Problem under Uncertainty, Young H. Chun, Louisiana State University, Dept. of IS/DS, Ourso College of Bus. Admin., Baton Rouge, LA 70803-6316, chun@lsu.edu

The rank-based sequential decision problem is studied for a model involving a discrete time period and then generalized in terms of continuous time. We also consider a Bayesian estimation of the uncertain probability of having an offer at each stage in the discrete-time model and the arrival rate of offers in the continuous-time model.

2) Validation & Verification: Model vs. Real World, J. D. Selby-Lucas, Old Dominion University, Dept. of Eng. Mgmt., Norfolk, VA 23259, jselbylu@odu.edu, **William W. Swart**

Simulation models are being utilized for problem solving and decision making. We will discuss a simulation model utilized in the fast food industry and the validation and verification techniques utilized in its development and implementation. We suggest that the traditional pre-implementation model verification and validation approaches are not sufficient to assure post-implementation performance.

3) A Numerical Analysis to Preemptive Priority System & Nonhomogenous Poisson Arrivals, Nadia Wagieh Talaat, Cairo University, Math. Statistical Dept., Inst. of Stat. Study/Research, Cairo, Egypt, nadia_wt@yahoo.com

The PSA is a new tool for the performance evaluation of multi-queue systems. This algorithm is extended to the multi-queue preemptive resume priority system and Markov modulated Poisson arrivals for the higher priority. The model consists of vector of components which describe the number of jobs in each queue and the modulated state...

4) Decision Support for the Home Health Care Aide, Lisa A. Zidek, University of Wisconsin, 7400 S North Cape Rd., Franklin, WI 53132, zidek@msoe.edu

Home health care agencies need to establish a means of supporting the home

health aide to ensure quality care is provided to the patients. One method of support is a model to assist the aide with decision making. Decision support will help the aide better understand the choices available.

SD03 New Developments in Military Simulation

Sponsor: Military Applications Society

Sponsored Session

Chair: Jeff Appleget, US Army, TRADOC Analysis Command, Monterey, CA

1) Spectrum: A Training Simulation for Military Operations Other Than War, Dennis Chrisman, National Simulation Center, 410 Kearny Ave., Ft. Leavenworth, KS 66027, chrismad@leav-emh1.army.mil, **Ed Kastner**

2) CombatXXI: A High Resolution Combat Analysis Tool for the New Century, David R. Durda, US Army TRADOC Analysis Center, ATTN: ATRC-WEC, WSMR, NM 88002-5502, durda@trac.wsmr.army.mil, **Lounell D. Southard**

3) A Framework for Component-Based Simulation Modeling, Arnold H. Buss, Naval Postgraduate School, TRAC-Monterey, Box 8692, Monterey, CA 93943-0692, abuss@nps.navy.mil

SD04 Military Applications II

Contributed Session

Chair: Gary E. Horne, The MITRE Corporation, 4924 Andrea Ave., Annandale, VA 22003, hornege@mccdc.usmc.mil

1) Optimal Weapon Allocation with Target-Dependent Kill Probabilities, Chien-Ching Cho, The MITRE Corporation, 202 Burlington Rd., Bedford, MA 01730, cccho@mitre.org

A simple procedure is shown to optimally allocate a given number of weapons to targets with target-dependent kill probabilities. It maximizes the total expected kills or the probability of complete kills. This procedure generalizes the known result of uniform weapon allocation to targets each with the same kill probability.

2) Lanchester Models of Combat with Uncertain Coefficients, Robert J. Dickson, Dept. of National Defence, CORA 1 Canadian Air Division, Box 17000, Stn Forces, Winnipeg, Manitoba, R3J 3Y5, Canada, rdickson@ora.dnd.ca

A Lanchester formulation of a military battle of attrition is discussed that incorporates the uncertainty inherent to the coefficient terms of the model. Bounded linear uncertainties are considered with an analysis performed on the extent of the resulting deviation from the dynamics of the unperturbed system.

3) Systems Effectiveness Analysis Simulation Concept Design Center Synthetic Aperture Radar Architecture Study, Stacy Georgilas, Sp & Missile Systems Center, Developmental Plan Directorate, 180 Skynet Way, Ste. 2234, El Segundo, CA 90245-4687, stacy.georgilas@losangeles.af.mil, **Melissa Wright**

The wargame model in the Air Force Tool Kit, SEAS, was used to determine the impact of providing allied forces with additional SAR capabilities in a 2016 Asian scenario. Two SAR architectures including LEO satellites, Predator and Global Hawk UAVs and UX-1 and -2 were programmed into SEAS to obtain the number of allied aircraft lost and enemy aircraft and vehicles destroyed.

4) Operational Synthesis Applied to Military Questions, Gary E. Horne, The MITRE Corporation, 4924 Andrea Ave., Annandale, VA 22003, hornege@mccdc.usmc.mil

We describe combined efforts of the Marine Corps Combat Development Command and the New Zealand Defence Establishment in the area of operational analysis. The process of operational synthesis is a complement to traditional operational analysis in that it focuses on understanding nonlinearity, co-evolution and the intangibles of warfare.

SD05 Nicholson Student Paper Prize Competition II

Prize Session

Chair: Noah F. Gans, University of Pennsylvania, OPIM Dept., The Wharton School, Philadelphia, PA 19104-6366, gans@wharton.upenn.edu

1) Nicholson Student Paper Prize Competition

This session features selected finalists in the Nicholson Student Paper Prize Competition. It represents an opportunity for faculty, professionals and other students to see some of the best research being performed by students. All are welcome.

SD06 Empirical Research in Service Design

Cluster: Service Design
Invited Session

Chair: Larry Menor, University of Western Ontario, Ivey Sch. of Bus., 1151 Richmond St. North, London, Ontario, N6A 3K7, Canada, lmenor@ivey.uwo.ca

1) Designing Flexibility into Electronic Consumer Services, Gregory R. Heim, University of Pennsylvania, Mktg. Dept., The Wharton Sch., 1400 SH-DH, Philadelphia, PA 19104-6371, heim@mktgmail.wharton.upenn.edu, **Kingshuk K. Sinha**

We present a conceptual model of process flexibility dimensions for electronic consumer services. We demonstrate the application of the model to understand process attribute data available for conducting empirical analyses. We present results relating configurations of services and their flexibility characteristics to customer perceptions of electronic service quality.

2) Service Excellence: The Missing Link in the Service Profit Chain, Aleda V. Roth, University of North Carolina, Kenan-Flagler Bus. Sch., CB 3490, McColl Bldg., Chapel Hill, NC 27599-3490, aleda_roth@unc.edu, **Richard B. Chase, Christopher Voss**

We address service excellence and the missing links in the service profit chain model. First, we examine the influence of e-commerce as opening a new set of channel options for service providers. We explore this issue from a strategic service design perspective using the Huete-Roth service process matrix that links the degree of industrialization and degree of product standardization.

3) The "Fuzzy Front End" of Survey Research: Towards a "Design Focused" Scale Development Logic, Larry Menor, University of Western Ontario, Ivey Sch. of Bus., 1151 Richmond St. North, London, Ontario, N6A 3K7, Canada, lmenor@ivey.uwo.ca, **Aleda V. Roth**

We articulate a multi-item scale-development logic of survey research that provides pre-instrument construction assessments of item validity and reliability. Nominal scale data are collected through an item-sorting technique and analyzed. This scale-development logic is applied to the systematic design of items tapping the new service development competence and performance constructs.

4) Product Variety Management in Retail Services: A Market-Utility-Based Approach, Rohit Verma, DePaul University, Dept. of Mgmt., 1 East Jackson Blvd., Chicago, IL 60604, rverma@condor.depaul.edu, **H. Oppewal, Kitty Koelemeijer**

Assortment composition (variety) is a key issue faced by retail establishments. Given limited shelf space, which items should be added or deleted from the assortment? We present a market-utility-based model for effectively managing product variety in retail establishments. Empirical results from the cut-flower industry are presented.

SD07 Manufacturing

Contributed Session

Chair: Andrew K. Taft, Taft-MRC Consultants, Box 124, Okemos, MI 48805-0124, andrew.taft@sagra.lu

1) Manufacturing Systems Modeling, Design & Evaluation using Petri Nets, Amr B. Ettawil, Alexandria University, 7334 SW 80 St. Plaza, Apt. 282, Miami, FL 33143, amr_eltawil@hotmail.com, **Shihab Asfour, Hamdy Elwany**

Petri nets have been successfully used in the modeling, design and evaluation of several types of manufacturing systems. We review the basics of Petri nets and their applications in manufacturing systems design. After discussing recent research, we conclude by elaborating on prospective research opportunities.

2) Optimal Control of a Two-Machine Line with Machine Maintenance, Kenichi Nakashima, Osaka Institute of Technology, 5-16-1 Omiya Asahi-ku, Osaka, 353-8585, Japan, nakasima@dim.oit.ac.jp

We deal with a 2-machine line with deterministic processing time. Each machine has its own probability of the failure and that of the repair, respectively. After the repair or the maintenance, the probability of the failure is reduced. We show optimal control of machine maintenance.

3) Operation Analysis & Design for Easiness of Logistics in Production Systems, Hak Soo Mok, Pusan National University, Dept. of IE, 30 Changjeon-Dong, Kumjeong-Ku, Pusan, 609-735, Korea, hsmok@hyowon.pusan.ac.kr, **Hyun Chang Shin, Seung Tae Pyo**

In production systems, logistics are influenced by operation and material handling. The design of operation and material handling is the analysis of element work for workers and handling equipment to control the handling

process of part, subassembly and product. A proper operation method and sequence is determined by elimination of unnecessary element work and control of materials...

4) Sequencing & Scheduling Mixed-Model Assembly Line Balancing: A Survey, Ghorbanali Mohammadi, Brunel University, Dept. of Systems Eng., Uxbridge, Middlesex, UB8 3PH, UK, emp@gkmb@brunel.ac.uk

We identify and review the significant research in sequencing and scheduling in a mixed-model assembly line problem. A review of previous research permits that there is no universally accepted objective for determining the best model launching sequence. Balance efficiency of mixed-model tends to be higher for single model lines and the most practical launching discipline for mixed-models is fixed-rate launching...

5) A Game-Theoretic Rationale for Vehicle Size, Andrew K. Taft, Taft-MRC Consultants, Box 124, Okemos, MI 48805-0124, andrew.taft@sagra.lu

SUVs are becoming larger each year. This year, Ford introduced the mammoth 7000-pound Excursion, a vehicle so large it can barely fit into the average garage. Paradoxically, established vehicle models become smaller each year. We seek to provide a theoretical rationale for this phenomenon.

SD08 Reliability & Stochastic Orders

Sponsor: Applied Probability Society

Sponsored Session

Chair: Haijun Li, Washington State University, Dept. of Pure & Applied Math, Pullman, WA 99164, lih@haijun.math.wsu.edu

1) Multiple Failure Predictive Analysis in Probabilistic Safety Assessment, Paul Kvam, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205

We present methods for predicting future numbers of components failures for PSAs. The work is motivated and illustrated by discrete failure data from the nuclear industry, including failure counts for emergency diesel generators and pumps and motor operated valves. Current methods that assess component reliability in PSA rely heavily on simulation methods...

2) The Sudden Death Test: Planning Life Tests with a Limited Number of Test Positions, Jave Pascual, Washington State University, Dept. of Mathematics, Pullman, WA 99164

We present SDT plans to address the problem of limited testing positions in life tests. A single SDT involves testing k specimens simultaneously until the r th failure. The traditional SDT is a special case when $r=1$. The complete SDT plan consists of g single SDT's run in sequence...

3) Concentration Order on a Metric Space with Some Statistical Applications, Cheng Cheng, JHU, Dept. of Math. Sci., Baltimore, MD 21218, **Y. L. Tong**

A concept known as concentration order of probability distributions on a metric space is introduced and characterized along the line of Kamae, Krengel & O'Brien (1977). The norm stochastic order that compares real-parameter stochastic processes is introduced as a special case. Using Anderson's theorem, norm stochastic order of certain processes with almost-sure continuous sample paths are established...

4) First Passage Times for Markov Renewal Processes & Applications, Guang-Hui Hsu, Chinese Academy of Sciences, Inst. of Applied Math, Beijing, 100080, China, **Xue-Ming Yuan, Quan-Lin Li**

We propose a uniformly convergent algorithm for the joint transform of the first passage time and the first passage number of steps for general Markov renewal processes with any initial state probability vector. The uniformly convergent algorithm with arbitrarily prescribed error can be efficiently applied to compute busy periods, busy cycles, waiting times, sojourn times...

SD09 Inventory Policies in Supply Chains

Cluster: Inventory Management

Invited Session

Chair: Jeannette Song, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697, jssong@uci.edu

1) Managing Waiting Times of Backordered Demands in Single-Stage (Q,r) Inventory Systems, Tamer Boyaci, McGill University, Fac. of Mgmt. 1001, Sherbrooke St. West, Montreal, Quebec, H3A 1G5, Canada, boyaci@management.mcgill.ca, **Guillermo Gallego**

We present a service constrained (Q,r) model to manage waiting times of "backordered" demands. Our model controls not only the expected service performance but also curbs the variance of this service measure. We provide

optimality conditions and a streamlined algorithm for this model.

2) Capacity & Inventory Decisions in Make-to-Stock/Make-to-Order Supply Chains, Yashan Wang, MIT, Sloan Sch. of Mgmt., E53-353, 50 Memorial Dr., Cambridge, MA 02138, yawang@mit.edu

Manufacturers often use a hybrid of make-to-stock and make-to-order structure in their supply chains. Decisions on production capacities and on inventory levels need to be made long before demand can be observed or effectively forecast. We investigate how such decisions can be made efficiently to achieve a high service level.

3) The Virtues of Turn & Earn Allocation among Multiple Differing Retailers, Eran Liron, Stanford University, Grad. School of Bus., Stanford, CA 94305, **Evan L. Porteus**

A supply chain with 1 manufacturer with limited (and fixed) production capacity and many retailers is studied. The manufacturer cannot increase prices when there is a random surge in demand. Turn-and-earn, a form of history-based allocation, is helpful to both the manufacturer and the supply chain when retailers differ.

4) Performance Analysis & Optimization in an Assemble-to-Order System with Random Leadtimes, Jeannette Song, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697, jssong@uci.edu, **David D. Yao**

We analyze the performance of a single-product, assemble-to-order system. The component inventories are controlled by a base-stock policy and the replenishment lead-times for each component are i.i.d. random variables. Stochastic comparison techniques are employed to develop useful properties and easily computable bounds. Optimization issues are also considered.

SD10 Production Planning under Uncertainty

Cluster: Production Planning & Control under Uncertainty
Invited Session

Chair: John W. Fowler, Arizona State University, Dept. of IE, PO Box 875906, Tempe, AZ 85287-5906, john.fowler@asu.edu

Co-Chair: W. Matthew Carlyle, Arizona State University, Dept. of Imse, PO Box 875906, Tempe, AZ 85287-5906, mcarlyle@asu.edu

1) Reducing the Time Required to Blend the Final Product at an Oil Refinery, Shane Henderson, University of Michigan, Dept. of IOE, 2855 IOE Bldg., 1205 Beal Ave., Ann Arbor, MI 48109-2117, shane.henderson@umich.edu

At the Mardsen Point Oil Refinery in New Zealand, the final step in the refining process before product is loaded onto a ship is the blending step. We discuss an MIP that assigns pumps to tanks so that the blend is performed in minimal time, in an attempt to avoid demurrage costs from ship delays...

2) Workforce Planning under Uncertainty, Megan Walsh, Arizona State University, Dept. of IE, PO Box 875906, Tempe, AZ 85287-5906, meg13chi@netscape.net, **W. Matthew Carlyle, John W. Fowler**

Uncertain future product demand and operator availability can directly influence the optimal level of worker cross-training in a wafer fab. We use stochastic LP techniques to solve a multistage model with full recourse that will establish the cross-training levels in order to minimize expected cost while encouraging system flexibility.

3) Multi-Flow Semiconductor Capacity Planning under Uncertainty, Seung-Hee Shin, John W. Fowler, W. Matthew Carlyle

In wafer fabrication, uncertainties in equipment availability and product revenues can influence the optimal planned product mix. We develop a stochastic programming formulation of this problem and solve it using standard techniques. We indicate the value of using these methods instead of purely deterministic models.

4) Optimal Policy for Multiple-Stage Single Ordering Problems, Duan Li, Chinese University of Hong Kong, Dept of SE/EM, Ho Sin Hang Engineering Bldg., Shatin, Hong Kong, China, dli@se.cuhk.edu.hk, **Houmin Yan, Choi Tsan-Ming**

A discrete-time dynamic optimization formulation is proposed for multiple-stage single ordering problems with unknown demand. A Bayesian method is performed successively to update the probabilistic description of the demand. Dynamic programming and 2 approximation schemes are adopted to identify the optimal ordering time and quantity.

SD11 Data Mining Applications

Sponsor: Quality, Statistics & Reliability
Sponsored Session

Chair: Tom Au, AT&T, Short Hill, NJ 07078, ast@insight.att.com

1) Internet Traffic Data Analysis, Don X. Sun, Bell Laboratories, Lucent Technologies, 600 Mountain Ave., Murray Hill, NJ 07974, dxsun@research.bell-labs.com

We developed a framework for analyzing massive Internet traffic data for performance evaluation, network monitoring and traffic modeling. We will focus on the problem of LAN congestion monitoring and HTTP connection arrival time modeling. Some visualization tools will be presented for exploratory data analysis of the Internet traffic data.

2) Applying Data Mining: Case Studies of Business Success, Richard Rovner, SAS Institute, Inc., Analytic Solutions Mktg., SAS Campus Dr., Cary, NC 27513, rich.rovner@sas.com, http://www.sas.com

Data mining has become a key enabling technology for companies striving for competitive advantage. The opportunity to sift through vast information sources provided to analysts through data warehousing is yielding dramatic results. Industries as diverse as financial services, manufacturing, health care and telecommunications are applying data mining to problems focused on customer data...

3) Discriminating Data & Fax Traffic using Tree, Neural Network & Nearest Neighbor Methods, Tom Au, AT&T, Short Hill, NJ 07078, ast@insight.att.com, Fan Li, George Ma

Data and fax traffic have been growing rapidly and becoming a hundred billion dollar industry. With IP technology, the telecommunication industry is facing a critical technology migration issue. Since telephone customers are not obligated to inform the service carrier about which type of calls being made and received, the size and characteristics of fax and data traffic are largely unknown to the carrier...

SD12 Markov Decision Processes II

Cluster: Dynamic Programming
Invited Session

Chair: O. Hernandez-Lerma, CINVESTAV-IPIN, Dept. de Matematicas, A. Postal 14-470, Mexico DF, 07000, Mexico, ohermand@math.cinvestav.mx

1) Risk-Sensitive Optimal Control in Average Markov Decision Chains, Rolando Cavazos Cadena, UAAAN, Buenavista, 25315 Saltillo Coah, Mexico, rcavazos@uaaan.mx, **Emmanuel Fernandez-Gaucheraud**

Risk-sensitive average Markov decision processes with bounded costs are considered. If the state-space is finite and the transition law is communicating, the existence of bounded solutions for the optimality equation is established for every risk sensitivity coefficient, the result that is not valid if the state-space is denumerable.

2) Optimal Stationary Policies in Risk-Sensitive Dynamic Programs with Finite State-Space & Nonnegative Rewards, Rolando Cavazos Cadena, UAAAN, Buenavista, 25315 Saltillo Coah, Mexico, rcavazos@uaaan.mx, **Raul Montes-de-Oca**

We are concerned with controlled Markov chains with finite state-space and nonnegative rewards; it is assumed that the controller has a constant risk-sensitive and that the performance of a control policy is measured by a risk sensitive expected total-reward criterion. The existence of optimal stationary policies is studied within this context...

3) Adaptive Policies for Time-Varying Stochastic Systems under Discounted Criterion, Nadine Hilgert, INRA-ENSAM, Lab. de Biometrie, 2 place Viala, Montpellier Cedex 1, 34060, France, hilgert@ensam.inra.fr, **J. Adolfo Minijarez**

We consider a time-varying stochastic system evolving according to a non-stationary difference equation determined by a sequence of functions converging to some limit-function. The random disturbances are i.i.d. random vectors whose density is unknown. Considering possibly unbounded costs, we construct asymptotically discounted optimal adaptive policies for the limiting control system.

4) Large Deviations Analysis of Markov State Dependent Random Walks, Daniel Hernandez-Hernandez, Centro de Investigacion en Matematicas, Callejon Jalisco s/n, AP 402, Guanajuato GTO, Mexico, dher@fractal.cimat.mx, **Michele Boue**

We shall develop the large deviations principle for Markov state dependent random walks using dynamic programming and weak convergence methods.

SD13 Heuristic Search in Operations Planning & Scheduling

Cluster: Search in Combinatorial & Nonlinear Optimization
Invited Session

Chair: Joseph B. Mazzola, Georgetown University, McDonough Sch. of Bus., 37th & O St. NW, Washington, DC 20057, mazzolaj@msb.edu

1) Compressed Annealing: Simulated Annealing under Pressure, Jeffrey W. Ohlmann, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48105-2117, johlmann@umich.edu, **James C. Bean**

We discuss compressed annealing, a variant of simulated annealing. Introducing the concepts of pressure and volume to complement temperature, compressed annealing addresses optimization problems with relaxed constraints. Simultaneously adjusting temperature and pressure results in a primal/dual metaheuristic. Results illustrating computational effectiveness are reported.

2) A Model & Effective Algorithm for Optimal Box Selection in Packing Operations, L. Gong, Fairleigh Dickinson University, Silberman Sch. of Bus., Madison, NJ 07940, gong@alpha.fdu.edu, **Lei Lei, Z. Wang**

We consider the problems of selecting box designs for packing a given set of products to minimize the related costs. We formulate the problem into a transportation problem with additional side constraints and propose effective heuristic algorithms to solve this problem. Results are compared with the optimal solutions.

3) Asymptotically Optimal Technology Selection under Uncertainty, Shabbir Ahmed, University of Illinois, Dept. of Chemical Eng. & MIE, 600 South Mathews Ave., Urbana, IL 61801, s-ahmed@uiuc.edu, **Nick Sahinidis**

We address a multi-period investment problem for selection, acquisition and allocation of manufacturing technology in a stochastic environment. We formulate the problem as a multi-stage stochastic integer program for which we develop an LP-based heuristic. Under mild assumptions, we prove that the heuristic solution is asymptotically optimal with probability one.

SD14 Engineering Optimization

Cluster: Engineering Optimization
Invited Session

Chair: John E. Dennis, Rice University, CAAM, MS 134, 6100 Main St., Houston, TX 77005-1892, dennis@caam.rice.edu

1) Trajectory Optimization: Past & Present, John T. Betts, The Boeing Company, PO Box 3707, MC 7L-21, Seattle, WA 98124-2207, john.t.betts@boeing.com

We will focus on the evolution of methods used to solve trajectory optimization problems that occur in the aerospace industry. We will describe how advances in the field of NLP have permitted the solution of ever more challenging applications and illustrate the discussion with real world problems.

2) Techniques for Criteria Management for Constrained Multi-Objective Engineering Design Problems, W. Garth Frazier, AFRL, Material Process Design Branch, Mfg. Tech. Division, WPAFB, OH 45433, william.frazier@afml.af.mil

A key component in facilitating effective management of design criteria in a multi-objective optimization framework is the ability to present visual information concerning the tradeoffs among large numbers of decision variables and design criteria. We will focus on novel techniques for assisting designers to make optimal design decisions.

3) A Rigorous Framework for Optimization using Surrogates, John E. Dennis, Rice University, CAAM, MS 134, 6100 Main St., Houston, TX 77005-1892, dennis@caam.rice.edu, **Charles Audet, Douglas Moore, Andrew J. Booker, Paul D. Frank**

Some important problems in industrial design/control are governed by simulations that may cost upwards of a week for one run and then produce no value. We outline a new approach to such problems supported by a rigorous convergence theory and by great performance so far.

SD15 SDP/SDLCP: Theory & Algorithms

Cluster: Linear Programming/Complementarity
Sponsor: Optimization Section
Sponsored Session

Chair: Madhu Nayakkankuppam, Simon Fraser University, Dept. of Math. & Stats., Burnaby, BC, V5A 1S6, Canada, madhu@cs.nyu.edu

1) Complementarity Forms of Theorems of Lyapunov & Stein, M. Seetharama Gowda, UMBC, Dept. of Math. & Stats., Baltimore, MD 21250, gowda@math.umbc.edu

We describe complementarity versions of the classic theorems of Lyapunov (the positive stability of a matrix) for continuous-time dynamic systems and of Stein (all eigenvalues within the open unit disc) for discrete-time dynamic systems by considering certain complementarity problems over the cone of positive semidefinite matrices.

2) What Unifies Semidefinite & Convex Quadratic Programming, Farid Alizadeh, Rutgers University, Faculty of Mgmt., 640 Bartholomew Rd., Piscataway, NJ 08854-8003, alizadeh@rutcor.rutgers.edu, **Stefan Schmieta**

We will review the unifying framework of Euclidean Jordan algebras and show, through its mechanism, that we can translate and extend algorithms and their analysis among semidefinite programming convex quadratic programming and LP. As a result, we get all of the algorithms from the Monteiro-Zhang family of directions.

3) A General Framework for Establishing Polynomial Convergence of Long-Step Methods for Semidefinite Programming, Sam Burer, Georgia Institute of Technology, School of Math., Atlanta, GA 30332, burer@math.gatech.edu, **Renato D. C. Monteiro**

We consider feasible long-step primal-dual path following methods for SDP based on a family of Newton directions which can be parametrized by a nonsingular matrix. An iteration complexity bound is derived via a scaled norm of the second derivative of the function denoting the central path equations.

4) Bundle Methods for Large-Scale Semidefinite Programs, Madhu Nayakkankuppam, Simon Fraser University, Dept. of Math. & Stats., Burnaby, BC, V5A 1S6, Canada, madhu@cs.nyu.edu, **Francois Oustry, Michael L. Overton**

We consider bundle methods for SDPs that can be formulated as eigenvalue optimization problems. We discuss computational aspects based on our implementation and provide numerical results on some large benchmark problems.

SD16 Real-Time Transportation Systems II

Sponsor: Transportation Science Section
Sponsored Session

Chair: David E. Lucas, University of Arizona, SIE Dept., Tucson, AZ 85721, lucas@sie.arizona.edu

1) The SLC Light Rail Real-Time Traffic Signal Priority System, K. Larry Head, Gardner Systems, Inc., Tucson, AZ 85750, lhead@gardnersys.com

Real-time traffic signal priority is provided for the SLC light rail using recent developments in transit signal priority. Traditionally, preemption has been used to provide signal priority but can cause degradation to the coordinated signal operation. We will review the principles and operation of the SLC priority system.

2) Real-Time Adaptive Ramp Metering, Frank W. Ciarallo, University of Arizona, Dept. of SIE, PO Box 210020, Tucson, AZ 85721-0020, frank@sie.arizona.edu, **Douglas M. Getman, James Grabher**

The multiobjective integrated large-scale optimized ramp metering system uses a hierarchical structure to adaptively coordinate metering rates at several adjacent interchanges on a freeway. The system includes a higher level area-wide optimization formulation and a lower level predictive-cooperative real-time control strategy. We will describe the system's design and some implementation issues.

3) Estimating Queue Discharge Rates in Real-Time, David E. Lucas, University of Arizona, SIE Dept., Tucson, AZ 85721, lucas@sie.arizona.edu

RHODES, a real-time traffic adaptive control system, provides optimal signal control when it has accurate queue estimates. Queues discharge at varying rates during the day, negatively affecting the accuracy of queue estimates when fixed discharge rates are assumed. We describe several methods for updating these parameters in real-time.

SD17 Recent Advances in Microscopic Traffic Simulation II

Cluster: Microscopic Traffic Simulation
Invited Session

Chair: Andrzej Bargiela, Nottingham Trent University, Real-Time Telemetry Systems, Butron St., Nottingham, NG1 4BU, UK, andre@doc.ntu.ac.uk

1) The Role of Simulation in Advanced Traffic Management Systems, Jaime Barcelo, Universitat Politecnica de Catalunya, Dept. of Stats. & OR, Pau Gargallo 5, Barcelona, 08028, Spain, jaume.barcelo@upc.es

Advanced traffic management systems constitute one of the major applications of the intelligent transport systems. Various architectures and approaches have been proposed and tested in many projects of R&D programs of the European Commission. An approach shared by all has been the conception of the system as an intelligent DSS able to identify actual traffic conditions...

2) MITSIMLab: Recent Developments & Applications, Moshe E. Ben-Akiva, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1181, Cambridge, MA 02139, **Haris N. Koutsopoulos, Tomer Toledo**

We report on recent enhancements of the MITSIMLab in both functionality, e.g., public transportation, and modeling of driving behavior, e.g., intersection operations. We also discuss the application of the MITSIMlab in Stockholm, Sweden.

3) Microsimulation Issues in Traffic Management: The Needs of a Public Administration, Elvezia Cepolina, Comune di Genova, Dipt. Mobilita, Tras. e Parch., Genova, Italy, elma@comune.genova.it, **Maria Fassone**

The experience of the Mobility, Transport and Parking Directorate in traffic management activities led to the necessities of a public administration. Comparing the needs of Genoa Municipality with the performances of the microsimulators used arose the characteristics of an urban traffic control system integrated with monitoring systems and simulation tools...

SD18 Tools for Undergraduate OR/MS Education

Sponsor: INFORM-ED

Sponsored Session

Chair: James J. Cochran, University of Cincinnati, QAOM Dept., PO Box 210130, Coll. of Bus. Admin., Cincinnati, OH 45221-0130, cochraj@econqa.cba.uc.edu

1) An Integrative Exercise for Undergraduate Decision Analysis & International Management Students, Susan W. Palocsay, James Madison University, CIS/OM Program, MSC 0202, Harrisonburg, VA 22807, palocsw@jmu.edu, **Marion M. White**

We will describe an integrative learning exercise where students from an undergraduate course in decision analysis served as "consultants" on a case assigned to teams in an international management class. The exercise was designed to demonstrate the managerial relevance of decision analysis techniques and promote linkages between the disciplines.

2) A Project-Based Approach to PERT/CPM Instruction, Ronald J. Walker, Cedarville College, Box 601, Cedarville, OH 45314, walkerr@cedarville.edu, **Evan D. Wood**

Students in MS (MGMT 354) are introduced to a project for the development of training modules for Waterfield University. This case allows students to manage and track the progress of the project using Microsoft Project 98. The application provides exposure to implementation difficulties beyond the mathematical notions of typical PERT/CPM instruction.

3) You're Carrying Cocaine in your Wallet: A Simple & Effective Probability Case, James J. Cochran, University of Cincinnati, QAOM Dept., PO Box 210130, Coll. of Bus. Admin., Cincinnati, OH 45221-0130, cochraj@econqa.cba.uc.edu

In an undergraduate introductory course, we discuss the use of a simple and effective case in probability.

SD19 Telecommunication Network Design

Invited Session

Chair: Jeffery L. Kennington, SMU, Dept. of Comp. Sci. & Eng., Dallas, TX 75275, jlk@seas.smu.edu

1) Optimizing a SONENT Design, Eli V. Olinick, SMU, Dept. of Comp. Sci. & Eng., Dallas, TX 75275, olinick@seas.smu.edu

We address a difficult design problem for a network employing multiple SONENT rings. After proposing an optimization model for selecting and sizing a

minimum-cost ring set with sufficient capacity to satisfy a given demand pattern among sites on the network, we present an empirical analysis of heuristic solution techniques.

2) Capacity Planning for Mesh Restorable Telecommunications Networks, Gheorghe Spiride, Nortel Networks, 2400 Lakeside Blvd., Richardson, TX 75081, gspiride@nortelnetworks.com

We describe an optimization-based approach for capacity planning in mesh restorable telecommunications networks. An empirical analysis of the approach used is presented with results for realistically sized networks.

3) The Network Design Process, Augustyn Ortynski, Nortel Networks, Business & Network Consulting, Richardson, TX 75081, august@nortelnetworks.com

The design of survivable networks is a difficult and important problem faced by telecommunications service providers. We describe some of the network design approaches and techniques developed in Nortel Networks.

4) A Comparison of Arc-Path & Node-Arc Formulations for Allocating Spare Capacity in a Mesh Telecommunication Network, Jeffery L. Kennington, SMU, Dept. of Comp. Sci. & Eng., Dallas, TX 75275, jlk@seas.smu.edu

We say that a telecommunication network is survivable if it can continue to operate using its spare capacity after any single link failure. There are 2 mathematical formulations available for designing a survivable network: node-arc and arc-path. We performed an empirical analysis comparing these 2 formulations.

SD20 Web Mining for Decision Support & Electronic Commerce

Sponsor: College on Artificial Intelligence

Sponsored Session

Chair: Bamshad Mobasher, DePaul University, Dept. of Computer Sci., Chicago, IL 60604, mobasher@cs.depaul.edu

1) Evaluating the Quality of Commercial Web Sites, Myra Spiliopoulou, Humboldt-Universitaet zu Berlin, Inst. Wirtschaftsinformatik, Spandauer Str. 1, Berlin, 10178, Germany, myra@wiwi.hu-berlin.de, <http://www.wiwi.hu-berlin.de/~myra/>

We address the issue of evaluating and improving the quality of a website, measured by its success in satisfying the objectives of the site owner, e.g., by maximizing the conversion efficiency of site visitors. We propose the analysis of site usage by data mining techniques...

2) Warehousing the Web Data, Sanjay Kumar Madria, Purdue University, Dept. of Computer Sci., West Lafayette, IN 47907, skm@cs.purdue.edu, <http://www.cs.purdue.edu/people/skm>

We focus on the design issues for warehousing Web data. In particular, we discuss data models to store Web data (Web schema), Web algebra and query language based on previous work on WHOWEDA system. A user's query graph is used to populate the Web warehouse. We then apply algebraic operations to garner some more useful information...

3) NetMODEL: Representing & Manipulating Mined Knowledge in Real-Time, Maurice Mulvenna, University of Ulster at Jordanstown, Fac. of Informatics, Shore Rd., Newtownabbey, Antrim, BT37 0QB, Northern Ireland, md.mulvenna@ulst.ac.uk, **Alex Buchner, Matthias Baumgartner, Jianhan Zhu**

Existing data mining algorithms have several generic drawbacks. First, the output is usually in a form that is not readily understandable, making it difficult to apply the discovered marketing intelligence, e.g., for personalization activities in e-commerce. Secondly, the results are not represented in a format that allows the exchange of discovered knowledge across data mining applications...

4) Web Mining for E-Commerce: In Search of Actionable Results, Brij Masand, GTE Laboratories, Advanced Systems Lab., 40 Sylvan Rd., Waltham, MA 02451-1128, brij@gte.com

Web usage logs lead to the promise of mining Web behavior for targeted e-marketing and effective e-commerce sites. However, in practice, analysis of G-bytes of Web usage logs to recover sessions and reliable user profiles useful for business intelligence presents new challenges. We will focus on adapting Web usage mining results for practical impact on e-commerce revenue.

SD21 Robust Selection Procedures for Computer Simulation

Sponsor: College on Simulation

Sponsored Session

Chair: Barry L. Nelson, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, nelsonb@random.iems.nwu.edu

1) A Comparison of Procedures to Select the Best System, Stephen E. Chick, University of Michigan, Dept. of IOE, 1205 Beal Ave., Rm. 1777, Ann Arbor, MI 48109-2117, sechick@engin.umich.edu, **Koichiro Inoue**

We compare the performance of several procedures to select the best simulated system, including Rinott's and 2-stage and sequential OCBA and Bayesian decision-theoretic procedures. Each is tested on a broad range of selection problems. Advantages of a Bayesian formulation and sequential sampling are described.

2) Robust System Selection, Susan M. Sanchez, Naval Postgraduate School, OR Dept., 242 Glasgow Hall, 2nd Floor, Monterey, CA 93943, susan_sanchez@umsl.edu

Simulation analysts often seek to identify systems with the best mean performance. Selection procedures allow investigation of qualitatively different systems, while response surface metamodels are appropriate when alternatives are characterized by quantitative inputs. I discuss the selection for robust systems insensitive to uncertainties in model specification and the real-world environment.

3) Robustness of Ranking & Selection Procedures, David Goldsman, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332, sman@isye.gatech.edu, **William Marshall**

We examine a number of robustness issues with respect to the performance of certain popular ranking and selection procedures. For instance, we are interested in the effects of heterogeneity of the competing populations as well as correlation between populations or within the observations from each particular population.

SD22 Management & Technology

Contributed Session

Chair: Pedro M. Oliveira, University of North Carolina, Kenan-Flagler Bus. Sch., CB 3490, McColl Bldg., Chapel Hill, NC 27510, oliveirp@bschool.unc.edu

1) Implementation of a Technology in its Infancy: Utilization of the Internet for Grant Processing, Theresa L. Jefferson, George Washington University, Dept. of EMSE, Melvin Gelman Library, Rm. 704, Washington, DC 20052, tjeff@seas.gwu.edu, **Thomas J. Nagy**

In January of 1995, NASA began to experiment with utilizing the Internet to facilitate the grant proposal, review and award process. We outline both the technical challenges and non-technical, management issues critical to the successful implementation of a technology. Associated benefits and costs are presented.

2) Job Attraction Factors for New College Hires in High Technology, Burton V. Dean, San Jose State University, 1 Washington Square, San Jose, CA 95192-0070, bvdean@aol.com, **John R. Obermeyer**

We are concerned with identifying factors that new college graduates consider when evaluating employment opportunities with high technology firms. Results of focus groups and a statistical study of recent applicants to a major Silicon Valley technology-based firm are analyzed.

3) Approximate Decomposition in Global Technical Systems, Boris V. Peltzverger, Georgia Southwestern State University, 800 Wheatley, Americus, GA 31709, plz@canes.gsw.edu, <http://gswrs6k1.gsw.peachnet.edu/~plz/>

We review the classification of types of interactions of subsystems in complex technical systems. Estimates of internal, external and criterion interactions of subsystems which can be used for approximate decomposition are obtained.

4) Spin-Off in China: Why & How, Jiang Wen, University of Electro-Communications, MS Program, Grad. Sch. of IS, Chofu-gaoka 1-5-1, Chofu-shi, Tokyo, 182-8585, Japan, wen@kob.is.uec.ac.jp, **Shinichi Kobayashi**

We analyze the nature of high-tech firms created by academic researchers in China and the key factors that lead to their successes, based on the author's consultancy and a survey of leading academic-originated CAD companies. We demonstrate that successful spin-offs have been those with government policies, funding support and the capacity to create partnerships and alliances with actors from various sectors.

5) Technology Policies & Strategies for Late Industrialized Countries, Pedro M. Oliveira, University of North Carolina, Kenan-Flagler Bus. Sch., CB 3490, McColl Bldg., Chapel Hill, NC 27510,

oliveirp@bschool.unc.edu, **Pedro T. Conceicao, Manuel V. Heitor**

We seek to extend the understanding of the role of public investments in R&D in today's economy in late industrialized countries (LICs). The following questions are addressed: What should be the role of state intervention in the promotion of R&D? Can private R&D investments substitute public R&D investments in building a sustainable knowledge-base?...

SD23 Tournaments: Scheduling & Betting

Cluster: Non-Traditional OR

Invited Session

Chair: Edward Kaplan, Yale University, Yale Sch. of Mgmt., Box 208200, New Haven, CT 06520-8200, edward.kaplan@yale.edu

1) March Madness & the Office Pool, Edward Kaplan, Yale University, Yale Sch. of Mgmt., Box 208200, New Haven, CT 06520-8200, edward.kaplan@yale.edu

The annual conclusion to the US men's college basketball season is 2 single elimination basketball tournaments showcasing the best college teams. At the same time, office pools across the country try to pick a priori as many game winners as possible in the tournament. We show how to calculate the mean and the variance of the number of correctly predicted wins for a given slate of predicted winners...

2) The Traveling Tournament Problem, Kelly Easton, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332, **George L. Nemhauser, Michael A. Trick**

At the heart of Major League Baseball scheduling is the problem of finding a minimum distance double round robin tournament schedule. This basic problem may be simple to state but has proven incredibly difficult to solve. On one hand, it has a combinatorial design nature typical of sports scheduling problems...

SD24 Applications of DEA

Cluster: Data Envelopment Analysis

Invited Session

Chair: Joe Zhu, Worcester Polytechnic Institute, Dept. of Mgmt., 100 Institute Rd., Worcester, MA 01609, jzhu@wpi.edu

1) Extensions of Modified DEA, Mei Xue, University of Pennsylvania, Dept. of OPIM, The Wharton Sch., Philadelphia, PA 19104-6366, xuem@wharton.upenn.edu, **Patrick T. Harker**

Andersen & Petersen (1993) presented an extension of the basic DEA methodology, called modified DEA, which has the desirable feature of ranking not only the inefficient DMUs, but the efficient ones as well. However, when their basic approach is extended to the cases of variable returns to scale and non-discretionary inputs, several conceptual problems arise...

2) Efficiency of US Airline Firms, Rajiv Banker, University of Texas at Dallas, Sch. of Mgmt., JO4.3, Richardson, TX 75083, rbanker@utdallas.edu, **Surya Janakiraman, Ram Natarajan**

We analyze the changes in the technical, allocative and scale efficiency of US airline firms using new statistical tests to compare DEA efficiency scores. We explain variations in efficiency scores in terms of managerially relevant variables.

3) Service Applications of DEA, Joe Zhu, Worcester Polytechnic Institute, Dept. of Mgmt., 100 Institute Rd., Worcester, MA 01609, jzhu@wpi.edu, **Lawrence M. Seiford**

Session participants will discuss their most challenging applications of DEA and plan applications-oriented sessions for INFORMS San Antonio.

SD25 Academic & Industry Collaboration on Supply Chain Management & E-Commerce

Sponsor: CPMS

Sponsored Session

Chair: Grace Lin, IBM Corporation, TJ Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, gracelin@us.ibm.com

1) Teaching E-Business & Supply Chain Management: An Experience of Industry-Academic Collaboration, Hau L. Lee, Stanford University, Dept. of IE/EM, Terman 351, Stanford, CA 94305-4024, haulee@leland.stanford.edu

The world of e-commerce and how it impacts supply chain management is progressing at such a rapid pace that academics and industry are learning jointly about innovations and developments. I will share experiences on an attempt to develop and teach a course on this subject, drawing upon significant

contributions and participation from industry.

2) Research in Business-to-Business Electronic Commerce, Michael J. Shaw, University of Illinois, Dept. of Business Admin., 350 Commerce West, Champaign, IL 61820, m-shaw2@uiuc.edu

We will begin with an overview of the research area concerning B2B e-commerce. Several research projects will be reviewed to address issues related to procurement, exchanges and supply-chain coordination.

3) Industry-Academia Collaboration in E-Commerce & Supply Chain Management, Sherman X. Bai, University of Florida, Dept. of ISE, 303 Weil Hall, Ctr. for E-Commerce Tech., Gainesville, FL 32611, bai@ise.ufl.edu, **Gary Sullivan, Kenneth J. Fordyce**

We share experiences of industry-academia collaboration between IBM and the University of Florida at the Center for Electronic Commerce Technology & Supply Chain Management. We will also discuss the mechanisms of initiating and sustaining strong industry-university relationships in advanced R&D.

4) Supply Chain Projects at the Logistics Institute at Georgia Institute of Technology, John J. Bartholdi, III, Georgia Institute of Technology, School of ISyE, Atlanta, GA 30332-0205, john.bartholdi@isye.gatech.edu

The Logistics Institute conducts long-term research projects with many of its almost 30 industry members. We briefly survey some of the more interesting ones to illustrate the mutual benefits that can come from such collaboration and mention some of the challenges.

SD26 Global Partnership, Quality, Information Systems

Cluster: Global Partnership, Quality, Information Systems
Invited Session

Chair: Peter Chamoni, Gerhard Mercator University, FB5: MIS & MS, Lotharstr. 65 LF221, Deisburg, D-47048, Germany, chamoni@uni-duisburg.de

1) Data Envelopment Analysis for Quality Management in Design-of-Experiments of DaimlerChrysler Fluid Laboratory, Jorg Keller, DaimlerChrysler AG, FT3/KL, PO Box 2360, Ulm, D-89013, Germany, joerg.keller@daimler.chrysler.com, **Isabelle Holzer, Helmut Berrer**

Quality management in the conceptual design of engines is a major task of the automotive industry to face tougher governmental restrictions on fuel consumption and exhaust emissions. The cylinder head and especially the intake port concept design have an important influence. In phase of port conception, a quick tool is required by the design engineer for ranking the concepts of intake port geometry...

2) Evaluating Marketing Strategies using System Dynamics Models, Adolfo Crespo Marquez, Universidad de Sevilla, Escuela Superior de Ing., Camino de los Descubrimientos, Sevilla, SN 41092, Spain, crespo@iies.es, adolfo.crespo@esi.us.es, **Carol Blanchar**

We describe the possible utilization of system dynamics models to improve the process of selecting better marketing strategies. The pay-back and accountability of marketing investments is analyzed by means of the system dynamics formal models offering the opportunity to compare strategies for a segmented market, under different scenarios and for a set of customized metrics.

3) Business Information Warehouse: Concept, Models & Practice, Peter Chamoni, Gerhard Mercator University, FB5: MIS & MS, Lotharstr. 65 LF221, Deisburg, D-47048, Germany, chamoni@uni-duisburg.de, **Michael Staade**

Data warehousing and data mining provide powerful tools for analytical ISs. Based on a classic approach of relational or multidimensional online analytical processing, we describe the architecture and benefits of the SAP business information warehouse. The conceptual model for the extraction of business content from legacy systems allows rapid prototyping...

SD27 Revenue Management & Booking Control I

Cluster: Pricing & Revenue Management
Invited Session

Chair: Dimitris Bertsimas, MIT, Sloan Sch. of Mgmt., Bldg. E53-363, Cambridge, MA 02139, dbertsim@mit.edu

1) When Inventory isn't Controlled by Value, Andy Boyd, PROS Strategic Solutions, 3223 Smith St., Ste. 100, Houston, TX 77006, aboyd@prosweb.com, **Mikael Weigelt**

Revenue management in the airline industry is complicated by the fact that the primary inventory control mechanism is protection limits on the sale of leg booking classes. We discuss practical methods for achieving maximum network revenue within this control framework.

2) Revenue Management in a Dynamic Network Environment, Ioana Popescu, INSEAD, Tech. Mgmt. Dept., Blvd. de Constance, Fontainebleau, 77300, France, ioana.popescu@insead.fr, **Dimitris Bertsimas**

We propose an efficient dynamic algorithm for a stochastic network revenue management problem, based on approximate DP with non-additive bid-prices. We compare this with additive bid-price policies and prove nice structural and asymptotic properties. We extend the model to handle cancellations and overbooking and provide computational results.

3) Optimal Pricing & Booking Control in a Single Leg Flight Model, Youyi Feng, National University of Singapore, Dept. of IS, Sch. of Computing, Singapore, 119260, Singapore, fengyy@comp.nus.edu.sg, **Baichun Xiao**

We consider the problem of consolidating pricing and booking controls in a single leg flight. There are a finite number of fare classes in the flight which can each be priced at a set of allowable levels. Assuming that demand for a price of certain fare class forms a non-homogeneous Poisson process and price shifts cost almost nothing...

SD28 Location Models II

Sponsor: Society of Location Analysis

Sponsored Session

Chair: Zvi Drezner, California State University, Dept. of MS/IS, Fullerton, CA 92834, zdrezner@fullerton.edu

1) Rectilinear Distance Location in the Presence of Barriers, Roy Segars, Jr., Clemson University, Dept. of Math. Sci., Box 340975, Clemson, SC 29634, rsegars@clemson.edu, **P. M. Dearing**

In the presence of barriers, through which travel and facility locations are prohibited, distance is nonconvex. For rectilinear barrier distance, the feasible region is partitioned into convex subsets on which distance is convex. Thus, location problems defined by convex, nondecreasing functions of barrier distances may be solved by existing methods.

2) On Strong & Weak Formulations for the Max Cover Problem: Is "Strong" Necessarily Better?, Oded Berman, University of Toronto, Rotman Sch. of Mgt., 105 St. George St., Toronto, Ontario, M5S 3E6, Canada, berman@fmgmt.mgmt.utoronto.ca, **Dmitry Krass**

We examine 2 formulations for the max cover problem, one stronger than the other. "Common IP wisdom" suggests that the stronger formulation should be preferable computationally. However, the 2 bounds on the gap between the LP-relaxation and IP are shown to be identical. Our results are supported by computational experience.

3) A Competitive Facility Location Problem under Round Trip Distances, Shogo Shiode, Kobe Gakuin University, Faculty of Econ., Arise 518, Ikawadani, Nishi-ku, Kobe, 651-2180, Japan, shiode@eb.kobegakuin.ac.jp, **Shigehiro Osumi**

We consider a Stackelberg equilibrium model of 2 competitive companies that locate facilities to maximize total buying power. Customers commute by train and select the shortest round trip tour to incorporate shopping trips on the way home. We present an efficient solution procedure to solve this problem.

4) Sensitivity Analysis to the Value of p to the I-p Distance Weber Problem, Zvi Drezner, California State University, Dept. of MS/IS, Fullerton, CA 92834, zdrezner@fullerton.edu, **George O. Wesolowsky**

We analyze the sensitivity of the I-p distance Weber problem to the value of p. We find the set of possible optimal locations when p is in a given range. We also find the location that minimizes expected cost and the expected value of perfect information. Computational results are presented.

SD29 Panel: The OR/MS Pipeline

Sponsor: Forum on Women in OR/MS

Sponsored Session

Chair: Donna C. Llewellyn, Georgia Institute of Technology, Ctr. for Enhancement Teaching/Learning, Atlanta, GA 30332-0383, donna.llewellyn@oars.gatech.edu

1) The OR/MS Pipeline, Collette R. Coullard, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, coullard@iems.nwu.edu, **Donna C. Llewellyn, Robin Lougee-Heimer, Elise D. Miller-Hooks, Candace A. Yano**

This session will consist of a set of presentations and a panel discussion about the pipeline of women in engineering in general and in the OR field in specific. Each presenter has collected data from her home institution and we have some national data to help track how women enter and leave the education and

professional pipeline...

SD30 Distribution System Design

Sponsor: MSOM

Sponsored Session

Chair: Russell D. Meller, Virginia Tech., 250 New Engineering Bldg., Blacksburg, VA 24061, rmeller@vt.edu

1) **Distribution Network Structure Optimization under Economies of Scale**, *Alain Martel*, Université Laval, Fac. des Sci. & Admin., Québec, Québec, G1K 7P4, Canada, alain.martel@fsa.ulaval.ca, *Uday Venkatadri*

We discuss a class of location-allocation problems involving several product families, several echelons, capacity expansion or contraction possibilities by technology type at the facilities and economies of scale at the facilities. After explaining the problem context, we present the optimization model and the scenario improvement approach developed to solve it.

2) **A Strategic Model for the Design of Global Logistics Systems**, *Marc Goetschalckx*, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, marc.goetschalckx@isye.gatech.edu, *Carlos J. Vidal*, *Tjendera Santoso*

The international features and properties of the corresponding mathematical programming algorithms that differentiate the global logistics model will be presented. Numerical experiences from an industrial case study will be described. Finally, the importance and impact of flexibility and robustness will also be discussed.

3) **The Implications of Electronic Commerce for Distribution System Design**, *Arthur M. Geoffrion*, UCLA, Anderson Grad. Sch. of Mgmt., Box 951481, Los Angeles, CA 90095-1481, ageoffri@anderson.ucla.edu

Established companies that are ramping up their e-commerce activities find that even previously excellent distribution system designs quickly become unbalanced. We detail the main ways in which e-commerce tends to cause such difficulties and consider how best to achieve rebalancing.

4) **From Location & Inventory Interactions to Cost & Service Interactions**, *Russell D. Meller*, Virginia Tech., 250 New Engineering Bldg., Blacksburg, VA 24061, rmeller@vt.edu

Analytical models can give some insight into the basic interactions in distribution systems. The interactions between location and inventory have been modeled. What about the interaction between cost and service? Thoughts are discussed and an example from Frito-Lay, Inc. is presented.

SD31 Pricing & Contracts Design

Sponsor: MSOM

Sponsored Session

Chair: Sridhar Seshadri, NYU, Stern Sch. of Bus., 7-05 Tisch, Op. Mgmt., 40 West 4th St., New York, NY 10012, sseshadri@stern.nyu.edu

1) **Non-Binding Employment Contracts & Increases in Outsourcing**, *Wedad Elmaghraby*, NYU, Stern School of Bus., 40 West 4th St., New York, NY 10012, welmaghr@stern.nyu.edu, *Cağlar Ozden*

We provide a motivation for the increase in outsourcing in JIT production systems. Using a bargaining game approach, we show that outsourcing contracts are often preferred by firms due to their ability to overcome the hold-up problems caused by incomplete employment contracts.

2) **Allocation of Capacity over the Internet: Reservation & Allocation Strategies for Customers with Time Preferences**, *Vipul Agrawal*, NYU, Stern Sch. of Bus., 40 West 4th St., Ste. 700, New York, NY 10012, vagrawal@stern.nyu.edu, *Giuseppe Lopomo*, *Sridhar Seshadri*

We study different mechanisms for the pricing and allocation of capacity to customers with heterogeneous and unknown preferences. The mechanisms include posting of prices and auctions with and without the possibility of resale. We compare the performance of each mechanism with the optimal selling procedure in terms of expected seller's profit and efficiency.

3) **Scheduling Flexible Job Shops through Bidding & Pricing**, *Michael L. Pinedo*, NYU, Stern Sch. of Bus., 40 West 4th St., New York, NY 10012, mpinedo@stern.nyu.edu

Consider a flexible job shop with the total weighted tardiness as the objective. We present a scheduling framework based on bidding and pricing. The scheduling rules depend on the level of information available to the various agents. The rules have to be determined through a game theoretic analysis.

4) **Self-Service or Full-Service?**, *Xiuli Chao*, NJIT, Dept. of IME, University Heights, Newark, NJ 07102, *Sridhar Seshadri*

Often a service provider has to decide whether or not to provide self- and full-service options, what to charge for these services and what level of service to provide. Using the model comprised of parallel heterogeneous queues, we analyze and provide partial answers to these questions.

SD32 Constraint Programming

Sponsor: Computing Society

Sponsored Session

Chair: Greger Ottosson, Uppsala University, IT & Comp. Sci. Dept., PO Box 311, Uppsala, 751 05, Sweden, greger@csd.uu.se, <http://www.csd.uu.se/~greger/>

1) **Algorithms for Hybrid MIP/CLP Models for a Class of Optimization Problems**, *Vipul Jain*, Dash Optimization, 115 River Rd., Ste. 1203, Edgewater, NJ 07020, vjain@dashopt.com, <http://www.dashopt.com>, *Ignacio E. Grossmann*

We consider optimization problems where some constraints are better suited for MIP and the others by CLP. We present decomposition and B&B algorithms that exploit the complementary strengths of MIP and CLP methods to solve hybrid MIP/CLP problems where the CLP part reduces to a feasibility problem.

2) **Adding Cutting Planes in Constraint Programming**, *Michela Milano*, University of Bologna, DEIS, Viale Risorgimento 2, Bologna, 40136, Italy, mmilano@deis.unibo.it, www.lia.deis.unibo.it/Staff/MichelaMilano/

In constraint programming, global constraints are independent subproblems that can encapsulate a linear description to prune variable domains based on cost considerations. We will discuss a possible methodology and advantages for integrating cutting planes techniques in constraint programming global constraints. Computational results on TSPTW will be presented.

3) **Inference & Relaxations of Global Constraints in Hybrid CP-IP Solvers**, *Greger Ottosson*, Uppsala University, IT & Comp. Sci. Dept., PO Box 311, Uppsala, 751 05, Sweden, greger@csd.uu.se, <http://www.csd.uu.se/~greger/>, *Erlendur S. Thorsteinsson*

Inference through constraint propagation is the main technique used in constraint programming to reduce search, whereas integer programming focuses mainly on relaxations. When these fields grow closer, it becomes natural to study relaxations and inference for the same (global) constraints as a means to combine CP and IP in hybrid solvers. We illustrate this for constraints in a configuration problem.

SD33 Decision Making under Uncertainty

Cluster: Choice Engineering

Invited Session

Chair: Hans Wolfgang Brachinger, Université de Fribourg, Seminar Fur Statistik, Avenue de Beaugard 13, Fribourg, CH-1700, Switzerland, hanswolfgang.brachinger@unifr.ch

1) **withdrawn - chair request of 3/28**, *Melanie Powell*, University of Leeds, Centre for Decision Research, 11 Blenheim Terrace, Leeds, LS2 9JT, UK, mp@lubs.leeds.ac.uk

2) **Risk Mitigation: Individual & Market Behavior**, *Jamie Brown Kruse*, Texas Tech. University, Dept. of Economics, vjilk@taacs.ttu.edu

We examine gender differences in individual bidding behavior in a market setting. In one treatment, full insurance against a loss at 5 different probabilities is offered via Vickrey auction. The second treatment presents the mirror image of the decision problem in gain space. This design allows us to separate risk attitude from bidding behavior related to the utility of winning the item auctioned.

3) **Financial Risks & Gender: Experimental Evidence & Theoretical Framework**, *Renate Schubert*, ETH Zurich, Zurich, Switzerland, schubert@wif.gess.ethz.ch, *Matthias Gysler*, *Hans Wolfgang Brachinger*

Gender-oriented experiments on financial decision-making reveal some ambiguity concerning the question of whether women's preferences imply higher risk aversion than men's. A promising theoretical approach is the perceived-risk/return model which postulates that a lack of gender differences in risk preferences may be due to women's higher risk perception and higher risk tolerance.

SD34 Tutorial: Using VBA in a Management Science Course**Invited Session**

Chair: Chris Albright, Indiana University, Kelley Sch. of Bus., Bloomington, IN, albright@indiana.edu

1) **Tutorial: Using VBA in a Management Science Course, Chris Albright**, Indiana University, Kelley Sch. of Bus., Bloomington, IN, albright@indiana.edu

I will explain how I incorporate VBA into an MS course. Instead of learning "only" how to develop spreadsheet models, students learn how to wrap these in DSSs that enable a non-technical end-user to generate user-friendly reports by simply entering the appropriate inputs. Programming may not be suitable for all MS courses, but I've found it to be a welcome break from a continual semester's worth of modeling...

SD35 Software Demonstration II**Software Demo Session**

Chair: To be announced

1) **e-Optimization.com, Christelle Colin**, e-Optimization.com, ccolin@e-optimization.com

Come see the very first demonstration of e-optimization.com, the Web's new information-rich meeting place for the entire optimization community. Find out how to get news, share ideas, access a wealth of data, profile your organization and make new connections. Attend the demonstration and find out how to be added to "Who's Who" and "Solutions Showcase."

2) **Wolfram Research, Inc.: Mathematica Link for Excel - All-Purpose Excel Add-In, Anton Rowe**, Wolfram Research, Inc., 100 Trade Center Dr., Champaign, IL 61820

Link the world's most popular spreadsheet to the world's leading computational engine. Excel provides ease-of-use and interface ubiquity. Mathematica provides the computational power, high-quality graphics and extensibility. You will be amazed at what you can develop inside a spreadsheet using the Mathematica link for Excel.

Sunday 17:00-18:00**SP36 Omega Rho Distinguished Lecture: Policy Modeling for Better Decisions - The Case of HIV Prevention**
Plenary Session

Chair: David F. Rogers, University of Cincinnati, Dept. of QAOM, CBA, PO Box 210130, Cincinnati, OH 45221-0130, david.rogers@uc.edu

1) **Omega Rho Distinguished Lecture: Policy Modeling for Better Decisions - The Case of HIV Prevention, Edward Kaplan**, Yale University, Yale Sch. of Mgmt., Box 208200, New Haven, CT 06520-8200, edward.kaplan@yale.edu

HIV prevention programs are intended to slow the spread of the AIDS virus in the population, so it not surprising that much of HIV prevention research has focused on evaluating the success (or lack thereof) of alternative interventions. Knowing whether programs "work" is necessary for constructing a coordinated HIV prevention strategy and mathematical models have proven useful in estimating the effectiveness of alternative prevention programs. However, public funds for HIV prevention are limited: the 1999 US Federal budget allocated \$775.3 million to HIV prevention activities (about 80% of the total federal AIDS spending or 4/10,000s of the total 1999 budget). Building a portfolio of prevention programs in such a resource-constrained environment requires thinking about HIV prevention as a function of investment. The question is not whether programs succeed or fail but rather how to form an effective portfolio of programs within a budget constraint. Over the past few years, researchers and policy officials in the US and abroad have paid increasing attention to this issue. Focusing on the decisions faced by public officials, mathematical models that link the operations of HIV prevention programs to epidemic outcomes and/or estimate the cost-effectiveness of programs in preventing new infections are in demand. This presentation will review and expand upon the issues raised, often via recourse to selected HIV prevention activities and associated policy models.

Monday 08:30-10:00**MW36 Welcome & Awards Session**
Plenary Session

Chair: To be announced

Monday 10:30-12:00**MB01 Panel: Resolved - Decision Analysts should be Certified**

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Ronald A. Howard, Stanford University, Dept. of EES & OR, Terman Engineering Ctr., Stanford, CA 94305-4023

1) **Panel: Resolved - Decision Analysts Should be Certified, Ralph L. Keeney**, University of Southern California, 101 Lombard St., Ste. 704W, San Francisco, CA 94111, keeneyr@aol.com, **Ward Edwards**, Wise Decisions, Inc., 11466 Laurelcrest Rd., Studio City, CA 91604, **James E. Matheson**, Strategic Decisions Group, 2440 Sand Hill Rd., Menlo Park, CA 94025-6900

Over the years, there have been proposals that some type of accreditation should be available or required for practicing decision analysts. A distinguished panel will discuss the pros and cons of such credentialing. Those attending will be invited to share their views on the subject.

MB02 Decision Analysis & Risk
Contributed Session

Chair: Robert F. Bordley, General Motors, Renaissance Center, Detroit, MI 48098, robert.bordley@gm.com

1) **Organizing Beliefs: A Fuzzy-Logic Method, Olivier Brandouy**, Fac. de Droit et des Sci. Economiques, 4 Place du Presidial, Limoges, 87000, France, olivier.brandouy@unilim.fr

We provide a fuzzy-logic method for organizing beliefs revealed when someone is asked to determine, in a set of "command variables," which one is more appropriate to achieve an objective. This method preserves all interactions between beliefs and allows to determine a "preference path." An application for behavioral-finance is presented.

2) **Ordinal Games, Jose B. Cruz**, Ohio State University, 752 Dreese Lab., 2015 Neil Ave., Columbus, OH 43210, cruz.22@osu.edu, <http://eewww.eng.ohio-state.edu/~cruz>, **Marwan A. Simaan**

We develop a new theory of games where there are no payoff functions, but only a rank ordering of decisions. The objective of each player is to select a decision that has certain degree of preference in comparison to other choices, taking into account the choices of all other players.

3) **Attributable Risk in Reliability & Risk Assessment, Richard D. Jarvinen**, Winona State University, Dept. of Math. & Stats., Winona, MN 55987, rdjarvinen@vax2.winona.msus.edu

AR is an emerging statistic that the author has introduced as a research consultant at the NASA Johnson Space Center to study space shuttle reliability and risk assessment. AR will be described and examples provided. Fundamentally, AR attributes to what extent a given risk factor, among perhaps many, is responsible for a given failure.

4) **A Target-Based Formulation of a Corporate Utility Function, Robert F. Bordley**, General Motors, Renaissance Center, Detroit, MI 48098, robert.bordley@gm.com

Wilson provided a utility-based framework for modeling a group as optimizing some group utility function. We show that reinterpreting utility as the probability of meeting an uncertain target provides an alternative approach to this problem. We find that our formulation replicates many of Wilson's results as well as leading to some additional results.

MB03 Army Model & Simulation Standards

Sponsor: Military Applications Society
Sponsored Session

Chair: Richard T. Maruyama, US Army Model & Simulation Office, ODCSOPS Attn: DAMO-ZS, 400 Army Pentagon, Washington, DC 20310-0400, richard.maruyama@hqda.army.mil

1) **The Role of M&S Standards in Simulation Development, Richard T. Maruyama**, US Army Model & Simulation Office, ODCSOPS Attn: DAMO-ZS, 400 Army Pentagon, Washington, DC 20310-0400, richard.maruyama@hqda.army.mil, **Curt Doescher**

The development and promulgation of accepted M&S standards can provide a valuable service to simulation developers. We will describe the Army's M&S standards development process and discuss how M&S standards can bridge the gap between requirements and the need to have a useful product in a timely manner.

2) **Standard Objects for Army Models & Simulations**, *Donald R. Hodge*, US Army - Army Research Laboratory, 392 Hopkins Rd., Attn: AMXSU-CS, APG, MD 21005, dhodge@arl.mil

We provide an overview of the activities of the object management standards category to include: a review of approved standard objects, platform and unit, a discussion of ongoing development in behavior, data collection, environment and location objects and plans for future development for urban and feature objects.

3) **Command Decision Modeling**, *Sean W. MacKinnon*, US Army National Simulation Center, Attn: ATZL-NSC-D, 410 Kearny Ave., Ft. Leavenworth, KS 66027-2345, mackinn@leavenworth.army.mil

CMD has been defined as: Procedures, practices, processes, techniques, data and algorithms that model or simulate human or automated behavior that result in a perception, a decision, an action or reaction or a plan. We will discuss CDM efforts, highlighting standards being produced to assist in the automation of simulations and will provide a demonstration of the experimentation environment for developing CDM standards...

4) **Dynamic Atmospheric Environments**, *Pat Black*, USACE Cold Regions Research Engineering Laboratory, USACE BYD, Bldg. 3002, Picatinny Arsenal, NJ 07860, pbb@crrel.usace.army.mil, *Richard Shirkey*

The dynamic atmospheric environments category includes the objects, algorithms, data and techniques required to replicate weather effects and impacts, backgrounds, acoustics and transport and diffusion of aerosols and battle by-products in models and simulations. Thus, this category has its roots in the atmosphere and atmospheric effects and impacts.

MB04 Integer Programming Applications
Invited Session

Chair: R. Kevin Wood, Naval Postgraduate School, OR Dept. OR/Wd, Monterey, CA 93943, kwood@nps.navy.mil

1) **Optimally Scheduling EA-6B Depot Maintenance**, *Rosser Baker*, Naval Postgraduate School, OR Dept., Monterey, CA 93943, robaker@nps.navy.mil, *Robert F. Dell*, *Bradley Meeks*

From Operation Desert Storm to the Balkans, EA-6B Prowler aircraft lie at the heart of tactical aircraft strikes. The Prowler community must continue to provide a fleet capable of such combat actions for the next 15 years. We describe an integer LP to schedule EA-6B depot maintenance services.

2) **An Integer Program & Heuristics for Tomahawk Land Attack Predesignation**, *Alexandra M. Newman*, Naval Postgraduate School, OR Dept., Monterey, CA 93943, newman@nps.navy.mil, *Richard Rosenthal*, *Brian Kirk*, *Bertram Hodge*, *Andrew Arnold*

During conflicts, strike coordinators assign Tomahawk Land Attack Missiles to targets manually without objectively evaluating effectiveness. We develop models to improve accuracy and consistency in targeting and save valuable time for strike coordinators. We present an integer programming-based model as a benchmark and results from several fast heuristics.

3) **Multi-Unit Network Interdiction**, *Ibrahim Akgun*, Naval Postgraduate School, OR Dept., Monterey, CA 93943, *R. Kevin Wood*

Suppose an adversary's forces are dispersed as separate units about a theater of war and we wish to limit inter-unit communication/transportation capabilities. Assuming limited interdiction assets, we demonstrate integer programming models, exact and approximate, for selecting the best communication/transportation links to interdict to achieve this goal.

MB05 Scheduling I

Cluster: **Scheduling**
Invited Session

Chair: Klaus H. Ecker, Technische Universität, Inst. f. Informatik, Julius Albert Str. 4, Clausthal, D-38678, Germany, ecker@informatik.tu-clausthal.de

1) **Solving Open Benchmark Problems for the Job Shop Problem**, *Peter J.S. Brucker*, University of Osnabrueck, Fac. of Math. & Info., Osnabrueck, D-49069, Germany, *W. Brinkkoetter*

A fast and efficient constraint propagation algorithm is presented for the job shop scheduling problem. In connection with a branching scheme, this algorithm is used to improve lower and upper bounds and to prove the optimality of solutions for benchmark problems which have been open for some time.

2) **A Tabu Search Algorithm for a Job Shop Problem with a Single Transport Robot**, *Sigrud Knust*, University of Osnabrueck,

Dept. of Mathematics & Info., Osnabrueck, 49069, Germany, *Peter J.S. Brucker*

We consider a generalization of the job-shop problem where the jobs have to be transported between the machines by a single transport robot. The objective is to minimize the makespan. A 2-stage TS algorithm is presented which changes machine orders in the outer stage and optimizes the robot in the inner stage.

3) **Shop Scheduling Problems with Secondary & Bicriteria**, *Jatinder N. D. Gupta*, Ball State University, Dept. of Mgmt., Muncie, IN 47306-0350, *Frank M. Werner*

We present an overview on recent results concerning the complexity, polynomially solvable cases as well as exact and heuristic solution procedures for shop scheduling problems with secondary and bicriteria.

4) **An Algorithm for Dynamically Scheduling Out-Forests**, *A. Rodriguez*, Ensenada, Mexico, *A. Tchernykh*, *Klaus H. Ecker*

We consider the problem of scheduling tasks on a multiprocessor system where only limited information about the dependence structure of the task set is available in advance. The objective is to minimize maximum makespan. A dynamic scheduling algorithm that uses available information about the number of immediate successors at run-time is analyzed...

MB06 Service Encounter

Cluster: **Service Design**
Invited Session

Chair: Scott Metlen, University of Utah, Eccles Sch. of Bus., Salt Lake City, UT

1) **Some Findings from Social Psychology & their Application to the Design of a Service Encounter**, *Richard B. Chase*, University of Southern California, Marshall Sch. of Bus., Marshall Bridge Hall 400, Los Angeles, CA 90089-1421, *Sriram Dasu*

A challenge in designing a service system is to operationalize factors that have the greatest bearing on how an encounter is evaluated during and after the encounter by the customer. We identify some interesting findings in social psychology and discuss how these can be used to guide design of service systems.

2) **Process Flexibility in Two-Server Queueing Systems**, *Sal R. Agnihotri*, Binghamton University, School of Mgmt., Binghamton, NY 13902-6015, agni@binghamton.edu

Our objective is to understand the basic components of process flexibility in services. The basic question is when is it economical to use flexible servers instead of specialists? In addition to taking into account the customer delay costs, we consider cost differences between specialists and flexible servers and obtain approximate closed form solutions which would give managerial insights.

3) **Service Provider's Dissatisfaction with Customer Behavior: Implications for Service Design**, *Rohit Verma*, DePaul University, Dept. of Mgmt., 1 East Jackson Blvd., Chicago, IL 60604, rverma@condor.depaul.edu

Service provider perceptions of recent unpleasant service encounters were obtained through structured interviews. Providers were asked to describe a recent unpleasant encounter emphasizing specific factors, which resulted in the unpleasantness. Interviews were content analyzed to identify categories of customer behaviors, which resulted in provider perceptions of unpleasant encounters...

4) **School Process Design: Mass or Professional Service?**, *Scott Metlen*, University of Utah, Eccles Sch. of Bus., Salt Lake City, UT

I propose that successful high schools have matched their process design to the extent of the homogeneity/heterogeneity of their external inputs. If a school's external inputs are homogeneous, then the process that enables effectiveness and efficiency is one with a high degree of labor intensity and a low degree of customization...

MB07 Operations Management I
Contributed Session

Chair: Sanjeev K. Bordoloi, College of William & Mary, Sch. of Bus., PO Box 8795, Williamsburg, VA 23187, skbord@business.wm.edu, http://business.wm.edu/skb

1) **withdrawn - author request of 3/29**, *Srinagesh Gavirneni*, Schlumberger, 8311 North FM 620, Austin, TX 78726, nagesh@slb.com

2) **Measuring Worker Forgetting with Intermittent Breaks in Manufacturing**, *David A. Nembhard*, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, nembhard@engr.wisc.edu, *Napassavong Osothsilp*, *Vikas Mehrotra*

A comparative study is conducted of various models for measuring human forgetting in manufacturing tasks. Comparisons are conducted on the basis of predictive performance using empirical industrial data. The value to managers of improved measurements are discussed along with the suggested applications of several specific forgetting models.

3) Analysis of Buyback Contracts in a Competitive Setting, Harish Krishnan, University of Michigan, 1634 Murfin Ave. #1, Ann Arbor, MI 48105, harishk@umich.edu, David Butz

Buyback contracts coordinate supply chains (achieve a vertically integrated solution) in single manufacturer/single retailer settings. We study a competitive model, the case where the retailer stocks 2 products (manufacturer's and private label) in a category. Retailer's stocking decision and the ability of buyback contracts to coordinate the channel are studied.

4) SISCO: The Simulator for Integrated Supply Chain Operations, Dean C. Chatfield, Pennsylvania State University, Dept. of MSIS, 119 Beam Bldg., University Park, PA 16802, dcc110@psu.edu, http://www.personal.psu.edu/dcc110, Terry P. Harrison, Jack C. Haya

We discuss SISCO, a Java-based tool that simplifies supply chain simulation model development by utilizing basic, customizable supply chain building-blocks, yet retains great flexibility by allowing full access to the underlying Silk simulation primitives and the Java data and control structures.

5) Design for Control: A Formalization of a New Perspective, Sanjeev K. Bordoloi, College of William & Mary, Sch. of Bus., PO Box 8795, Williamsburg, VA 23187, skbord@business.wm.edu, http://business.wm.edu/skb, Hector Guerrero

The process by which organizations undertake product design has undergone revolutionary changes recently. Although many DFC issues are common to design for manufacture/assembly, the sophistication of IT has become so pervasive in manufacturing that a direct focus on design's effect on control is imperative. We propose a new perspective that formalizes the conceptualization of DFC.

MB08 Applications of Markov Decision Processes & Applied Probability

Sponsor: Applied Probability Society
Sponsored Session

Chair: Julie E. Simmons Ivy, University of Michigan, Business Sch., 701 Tappan St., Ann Arbor, MI 48109-1234, jsimmons@umich.edu

1) Stochastic Control of Worksharing Systems, Esma G. Gel, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Tech. C210, Evanston, IL 60208, esma@iems.nwu.edu, Wallace J. Hopp, Mark P. Van Oyen

We present analytical models for the optimal control of worksharing between 2 workers in a stochastic flowline with general processing times and running under CONWIP. We show that an optimal policy will protect the less skilled worker with WIP and that partial cross-training of workers can increase system performance significantly.

2) Staffing Requirements & Shift Construction for Call Centers, Shane Henderson, University of Michigan, Dept. of IOE, 2855 IOE Bldg., 1205 Beal Ave., Ann Arbor, MI 48109-2117, shane.henderson@umich.edu, Andrew J. Mason

The construction of staff rosters for call centers usually proceeds in several steps. The first 2 steps are to determine staffing levels needed to provide adequate service and to find shifts that cover these staffing levels. We discuss the linkage between these problems and a method for exploiting the linkage.

3) Heuristics for the Selection of Maintenance Packages in Large-Scale Markov Decision Chains for Highway Maintenance, Rommert Dekker, Erasmus University, Econometrics & OR Dept., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, rdekker@few.eur.nl, Raymond Plasmeijer

Roads can deteriorate through ravelling, cracking, longitudinal and transversal unevenness. These damage characteristics can be addressed by several maintenance packages. We evaluate the average costs of a simple heuristic to select the best package with optimal policies, obtained from solving a very large MDP with real data.

4) Cost-Effective Monitoring Policies for a Multi-State Deteriorating Process with Probabilistic Monitoring & Silent Failures, Julie E. Simmons Ivy, University of Michigan, Business Sch., 701 Tappan St., Ann Arbor, MI 48109-1234, jsimmons@umich.edu

We determine cost-effective maintenance policies utilizing the theory of partially

observable Markov decision processes for multi-state deteriorating processes with probabilistic monitoring and silent failures when there is a cost associated with monitoring. Further, we examine the application of this type of maintenance model for medical decision making, diagnosis and treatment.

MB09 Retail Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Stephen A. Smith, Santa Clara University, OMIS Dept., Santa Clara, CA 95053-0382, ssmith@scu.edu

Co-Chair: Naren Agrawal, Santa Clara University, Omis Dept., Leavey Sch. of Bus., Santa Clara, CA 95053

1) In-Store Experiments to Determine the Impact of Price on Sales, Vishal Gaur, University of Pennsylvania, The Wharton Sch., Dept. of OPIM, Philadelphia, PA 19104, vishal@grace.wharton.upenn.edu, Marshall Fisher

Retail chains need to conduct in-store experiments to determine the impact of price and store execution on sales. We discuss how to design a price experiment and present results for a toy retail chain. One surprising finding: for some products, increasing price increases sales. Some explanations are offered.

2) Inventory Management of Products with Quality Variations, Garrett J. van Ryzin, Columbia University, 412 Uris Hall, Grad. School of Bus., New York, NY 10027, gjv1@columbia.edu, Siddharth Mahajan

Many products exhibit quality variations that cannot be controlled by a retailer, e.g., fresh produce. Customers, however, can select the highest quality units on hand or may not purchase if the quality of units on hand is too low. We discuss how such choice behavior impacts the retailer's inventory decisions.

3) Understanding Dual Distribution: Benefits & Challenges, Karen L. Donohue, University of Minnesota, Dept. of OMS, 3-150 CSOM, The Carlson Sch., Minneapolis, MN 55455-9940, kdonohue@csom.umn.edu, Marshall Fisher

We report on an empirical study of 4 retailers who produce products for sale in their own retail stores as well as through wholesale channels. We find that each channel offers unique advantages in terms of accessibility to customer and competitor information, inventory replenishment opportunities, brand awareness and strategies for new product introductions...

4) A Two-Period Model for Stocking Non-Identical Retail Stores, Stephen A. Smith, Santa Clara University, OMIS Dept., Santa Clara, CA 95053-0382, ssmith@scu.edu, Naren Agrawal

Retailers frequently re-optimize their inventory policies in certain stores in response to early season sales information. We consider the problem of determining which stores to stock and the corresponding service levels using a Bayesian model for demand uncertainty with learning in the first part of the season.

MB10 Planning I

Contributed Session

Chair: Jennifer R. Jackson, Carnegie Mellon University, 5000 Forbes Ave., Doherty Hall 4203D, Pittsburgh, PA 15213, jackson3@andrew.cmu.edu

1) A Branch Planning Problem, Vladimir I. Tsurkov, Russian Academy of Science, Computing Ctr., 40 Vavilov Str., Moscow, 117967, Russia, tsurkov@ccas.ru

A branch model with random coefficients is considered. We study deterministic equivalent statements. Their cost function and bidding constraints are special. Constructions of the decomposition algorithm described in detail use this.

2) Simulating Earthquake Damage to the Electric-Power Infrastructure: Applications to Urban Planning & Policy Development, Jonathan Dowell, Los Alamos National Laboratory, PO Box 1663, MS F604, Los Alamos, NM 87545, ljdowell@lanl.gov, Sudha Maheshwari

We present an integrated analysis method that has advanced the analyses of damage to the electric-power infrastructure caused by earthquakes. This method provides new OR tools to urban planners for mitigating earthquake damage. We discuss the method, examine applications and explore a scenario earthquake in the Los Angeles area.

3) Emergent Collective Behavior of Pedestrians in Cellular Automata Microsimulation, Victor J. Blue, New York State Department of Transportation, Planning & Program Mgmt. Group, 4 Burnett Blvd., Poughkeepsie, NY 12603, vblue@gw.dot.state.ny.us,

Jeffrey L. Adler

CA microsimulation of pedestrians is a new tool for the investigation of pedestrian movements. The pedestrian CA models to be presented are AI and A-Life models. The CA approach has allowed rapid progress in unidirectional (1998), bi-directional (1999) and cross- and 4-directional simulation (2000). The pedestrian microsimulation problem has been daunting, since pedestrians have more degrees of freedom than vehicles...

4) Optimal Retrofit of Process Networks, Jennifer R. Jackson, Carnegie Mellon University, 5000 Forbes Ave., Doherty Hall 4203D, Pittsburgh, PA 15213, jackson3@andrew.cmu.edu, **Ignacio E. Grossmann**

A 2-level strategy is proposed to systematically perform the overall retrofit of an existing chemical processing plant. A methodology for the high level is presented that models process flowsheets and retrofit modifications using a generalized disjunctive programming model reformulated as an MILP using convex hull formulation.

MB11 Advanced SPC Methodologies & Implementations

Sponsor: Quality, Statistics & Reliability

Sponsored Session

Chair: Jionghua Jin, University of Michigan, Dept. of IOE, 1927 IOE, Ann Arbor, MI 48109-2117, jhjin@engin.umich.edu

Co-Chair: Fugee Tsung, Hkust, Dept. of

le/em, Clear Water Bay, Kowloon, Hong Kong,

season@ust.hk

1) An EWMA Control Chart for Monitoring the Process Sample Range, Philippe Castagliola, Ecole des Mines de Nantes, Dept. Auto. Ctrl./Prod. Syst., 4 rue Alfred Kastler, BP 20722, Nantes Cedex, 44307, France, philippe.castagliola@emn.fr

If the properties and design strategies of the EWMA chart for the sample mean have been thoroughly investigated by Robinson & Ho (1978), Crowder (1987, 1989) and Lucas & Saccucci (1990), the use of the EWMA as a tool for monitoring other sample statistics has received little attention in the literature. We suggest methods of extending the classic use of the EWMA chart to the sample range of a process.

2) Statistical Monitoring & Control for Autocorrelated Observations in Industrial Systems, Harriet Black Nembhard, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, hbnem@engr.wisc.edu, **Christina Mastrangelo, Ming-Shu Kao**

It had been held that statistical process control (SPC) and engineering process control (EPC) were 2 distinct domains for process improvement. However, there are many appealing opportunities for designing control policies to integrate the two. We specifically consider the impact of developing an integrated policy for a first-order dynamic system with ARIMA...

3) A Product Design Improvement Priority Setting Based on Design Vulnerability & Warranty Data Analysis, Kai Yang, Wayne State University, Dept. of IE, Detroit, MI, kyang@mie.eng.wayne.edu

Long-term durability of automobile products is a major concern for the US industry. Given the limited budget allocated for design improvement, it is very important to find critical subsystems and components for maximum improvement effect. A priority setting method is discussed, based on design vulnerability model, warranty data analysis and LP. A case study is also included.

4) Statistical Quality Methods to Reduce the Bullwhip Effect, Hancong Liu, HKUST, Dept. of IEEM, Clear Water Bay, Kowloon, Hong Kong, hcliu@ust.hk, <http://home.ust.hk/~hcliu/>, **Kwok Tsui, Fugee Tsung**

An important supply chain research problem is the bullwhip effect caused by information distortion and variation amplification along a supply chain, which can lead to tremendous inefficiencies such as excessive inventory investment and lost revenues. Motivated by statistical quality methods, we propose a class of order-up-to policies and develop a nearly optimal policy to reduce the bullwhip effect.

MB12 Applications of Markov Decision Processes

Cluster: Dynamic Programming

Invited Session

Chair: Eugene A. Feinberg, SUNY, Dept. of Applied. Math & Stats, Stony Brook, NY 11794, eugene.feinberg@sunysb.edu, efeinberg@notes.cc.sunysb.edu

1) Anticipatory Routing, Barry Thomas, University of Michigan, Dept. of IOE, IOE Bldg., 1205 Beal Ave., Ann Arbor, MI 48109-2117, **Chelsea C. White, III**

A vehicle, traveling from an origin to a destination, may learn of intermediate stops en route. We present an MDP model, structural results and an AO*-based computational approach for route selection, based on probabilities that intermediate stops will be revealed once the vehicle has left the destination.

2) Play it Again, Sam? Optimal Replacement Policies for a Motion Picture Exhibitor, Martin L. Puterman, University of British Columbia, Fac. of Commerce & Bus. Admin., 2053 Main Hall, Vancouver, BC, V6T 1Z2, Canada, marty@coe.ubc.ca, **Sanjeev Swami, Charles B. Weinberg**

We describe the replacement problem faced by a movie theater manager and our formulation of it as a Markov decision process. Our model encompasses industry contract and a model for stochastic aging and decay of movie revenues. We discuss the structure of optimal policies and explore the effects of quality, quantity, contract terms and other model assumptions on exhibitor return.

3) Nonstationary Affine Dynamic Programs & Production Scheduling, Matthew J. Sobel, Case Western Reserve University, Dept. of OR & Op. Mgmt., WSOM, 10900 Euclid Ave., Cleveland, OH 44106-7235, mjs13@po.cwru.edu

Consider a multistage production model with a stationary structure including AR(p) demand and stochastic yields. Some of these models have an affine structure which leads to a relatively simple optimal policy. We present analogous results for affine dynamic models which are nonstationary and apply the results to multistage production models.

4) Constrained Continuous Time MDPs & Replacement Problems, Eugene A. Feinberg, SUNY, Dept. of Applied. Math & Stats, Stony Brook, NY 11794, eugene.feinberg@sunysb.edu, efeinberg@notes.cc.sunysb.edu

We consider a continuous-time version of a replacement problem when the goal is to minimize operational costs subject to the constraints on numbers of failures. Without preventive maintenance and replacement, the state of the systems deteriorates according to a continuous-time Markov chain. We show that switching replacement policies are optimal for this problem.

MB13 Sequential & Cooperative Search in Combinatorial & Nonlinear Optimization

Cluster: Search in Combinatorial & Nonlinear Optimization

Invited Session

Chair: Michel Toulouse, University of Manitoba, 545 Machray Hall, Winnipeg, Manitoba, R3T 2N2, Canada, toulouse@cs.umanitoba.ca

1) A Hybrid Scatter Genetic Tabu Search for Continuous Global Optimization, Theodore B. Trafalis, University of Oklahoma, Sch. of IE, 202 West Boyd, Rm. 124, Norman, OK 73019, trafalis@mailhost.ecn.ou.edu, **Suat Kasap**

We propose a HSGT search to find the global optimum of continuous global optimization problems with bounded variables. This approach combines the characteristics of modern metaheuristics such as scatter, GAs and TS. The development of the HSGT search, parameter settings, experimentation and efficiency are discussed.

2) Simulation & Performance Evaluation of Heuristics for QoS-Oriented Route Selection Algorithms, Krishnaiyan Thulasiraman, University of Oklahoma, Sch. of Comp. Sci., 200 Felgar St., Rm. 114, Norman, OK 73019-0631, thulasi@cs.ou.edu, **Anindya Das, Ravi Ravindran, Kaiyuan Huang, Gang Luo**

Given a network with costs and delays specified on each edge, the problem is to find a shortest path from a specified source to a specified destination with the total path delay not exceeding a specified value. We discuss a heuristic proposed by Huang et al and provide an evaluation of this heuristic through extensive simulations.

3) Multi-Level Cooperative Search: Application to Hypergraphs, Min Ouyang, University of Nebraska, Dept. of CS & Eng., 115 Ferguson Hall, Box 880115, Lincoln, NE 68588-0115, mouyang@cse.unl.edu, **Michel Toulouse, Krishnaiyan Thulasiraman, Fred W. Glover, Jetinder S. Deogun**

We introduce a multi-level cooperative search algorithm for the partitioning of hypergraphs. Multiple initial graphs are created whose nodes come from

different partial partitions. Refinement procedures explore the multi-level structure and exchanges of good partitions are performed among graphs, inducing the graphs to self-modify. Computational results are reported.

MB14 Stochastic Programming: Models & Computation

Cluster: Stochastic Programming

Sponsor: Optimization Section

Sponsored Session

Chair: David P. Morton, University of Texas, Grad. Program in OR, Austin, TX 78712, morton@mail.utexas.edu

1) **Hanford Waste Blending & the Value of Research: Stochastic Optimization as a Policy Tool**, *Timothy L. Johnson*, Carnegie Mellon University, Dept. of Eng. & Public Policy, 5000 Forbes Ave., Pittsburgh, PA 15213, tjohnson@andrew.cmu.edu, *Urmila Diwekar*

We describe a new optimization framework through its application to a complex policy problem: the vitrification of nuclear wastes. The augmented algorithm reproduces results that are robust and facilitates evaluation of important dimensions of the waste remediation effort; in particular, the value of devoting resources to research aimed at reducing uncertainty.

2) **Some Variance Reduction Techniques for Stochastic Programming**, *Tito Homem-de-Mello*, Ohio State University, Dept. of IWSE, 1971 Neil Ave., Columbus, OH 43210-1271, homem-de-mello.1@osu.edu

We discuss the application of variance reduction techniques in Monte Carlo simulation-based methods for stochastic optimization. We place particular emphasis on problems where the underlying random variables have discrete distributions and analyze methods that take advantage of this structure. Some numerical results are presented to illustrate the efficacy of such techniques.

3) **Verifying a Stochastic Solution using Meta-Computing**, *Golbon Zakeri*, University of Auckland, Dept. of Eng. Sci., Private Bag 92019, Auckland, New Zealand, g.zakeri@auckland.ac.nz

We present a brief description of meta-computing environments and the computational power that they provide. We will then describe how bounding methods can be implemented on such platforms. Users can submit their candidate solution of a stochastic programming problem to meta-NEOS for verification. Meta-NEOS will provide a confidence interval by taking advantage of the above setup.

4) **withdrawn - chair request of 3/20**, *Apostolos N. Burnetas*, Case Western Reserve University, Dept. of OR & Op. Mgmt., 10900 Euclid Ave., Cleveland, OH 44106-7235, atb4@po.cwru.edu, *Kamlesh Mathur, Julius R. Rachmantio*

MB15 Extensions of Linear Optimization

Cluster: Linear Programming/Complementarity

Sponsor: Optimization Section

Sponsored Session

Chair: Tamas Terlaky, McMaster University, Dept. of Computing & Software, Office JHE/214, Hamilton, Ontario, L8S 4L7, Canada, terlaky@cas.mcmaster.ca

1) **A New Polynomial Large-Update Primal-Dual Method for Linear & Semidefinite Optimization**, *Cornelis Roos*, Delft University of Technology, ITS/TWI/SSOR, Mekelweg 4, Delft, 2628 CD, The Netherlands, c.roos@its.tudelft.nl, *Geert-Jan Olsder, Robert-Jan van Emdon*

Interior-point methods (IPMs) for linear optimization can use small or large updates of the barrier parameter. Contrary to theoretical results, large-update IPMs are more efficient in practice than small-update IPMs. We partially close this gap between theory and practice. The extension to semidefinite optimization is straightforward.

2) **The Analytic Center Cutting Quadratic Method**, *Jean-Louis Goffin*, McGill University, Faculty of Mgmt., 1001 Sherbrooke West, Montreal, Quebec, H3A 1G5, Canada, jlg@crt.umontreal.ca, *Faranak Sharifi-Mokhtarian*

We extend the quadratic cut algorithm of Luo & Sun for solving the convex quadratic feasibility problem by placing or translating the quadratic cuts directly through the current approximate center. The number of recentering steps required to update from one approximate analytic center to the next is order one.

3) **Solving Semidefinite Programs via Nonlinear Programming**, *Renato D. C. Monteiro*, Georgia Institute of Technology, School of ISyE, Atlanta, GA 30332, monteiro@isye.gatech.edu, *Sam Burer, Yin Zhang*

We show that a large class of linear and/or nonlinear semidefinite programming problems can be converted into nonlinear optimization problems over "orthants"

of the form $\{Re^*n\} \{++\}$ times $\{Re^*NS\}$, where n is the size of the matrices involved in the problem.

MB16 Dynamic Fleet Management

Sponsor: Transportation Science Section

Sponsored Session

Chair: Hani S. Mahmassani, University of Texas, Dept. of Civil Eng., ECJ 6.2, Austin, TX 78712-1076, masmah@mail.utexas.edu

1) **An Approximation Algorithm for Real-Time Application to Time-Constrained Vehicle Routing & Scheduling**, *Xiubin Wang*, University of California, Inst. of Transport Studies, Irvine, CA 92697, xwang@uci.edu, *Amelia C. Regan*

We present an approximation algorithm for time-constrained vehicle routing and scheduling designed for application in problems in which the ratio of tasks to vehicles is relatively low. We develop a feasible solution and tight bounds on the optimal solution using a simple approximation algorithm which employs time-window discretization.

2) **On the Real-Time Truckload Pickup & Delivery Problem with Time Windows**, *Jian Yang*, University of Texas, MSIS Dept., Austin, TX 78712, jiany@uts.utexas.edu, *Patrick Jaillet, Hani S. Mahmassani*

The problem of minimizing the long-term average cost of operating a fleet in a square region is considered. The formulation for the off-line version of the problem is given. Based on this formulation and other simple heuristics, myopic on-line policies are constructed. Policies are also constructed that take advantage of knowing the demand arrival distribution...

3) **Local Optimization Approaches to Solve Dynamic Commercial Fleet Management Problems**, *Yongjin Kim*, University of Texas, Dept. of Civil Eng., ECJ 6.2, Austin, TX 78712, yongjin@mail.utexas.edu, *Hani S. Mahmassani, Patrick Jaillet*

We present a hybrid strategy to solve a truck load pickup and delivery problem with real-time information under time windows and computing time constraint. This strategy combines efficient dynamic local heuristics for quick initial assignment with formal optimization-based procedures for subsequent load reassignment decision within the time requirements of the dynamic problem.

MB17 Transportation Optimization

Contributed Session

Chair: Jacek Zak, Poznan University of Technology, 3 Piotrowo St., Poznan, 60-965, Poland, jacek_zak@ilim.poznan.pl

1) **Dynamic Bi-Directional Tube Control**, *Mark J. Ebben*, University of Twente, Faculty of Tech. and Mgmt., Veenstraat 80, Enschede, 7511 AT, The Netherlands, m.j.r.ebben@sms.utwente.nl, *Matthieu Heijden, Aart van Harten*

Due to cost considerations, a planned fully automated underground transportation system should contain bi-directional tubes, i.e., only 1 tube with traffic from both sides. Control rules should prevent collisions and try to minimize waiting times. We present a dynamic programming approach and heuristics for an isolated and network case.

2) **A Multicriteria Model for Rural Transportation Systems under Uncertainty using Fuzzy Logic**, *Nirmal Singh*, Beant College of Engineering & Technology, Dept. of Mech. & Prod. Eng., Gurdasup, Punjab, 143 521, India, nirmalsingh@mailcity.com, <http://www.bceetgsp.ac.in>

We focus on the application of fuzzy logic to the analysis of the multicriteria model for rural transportation systems under uncertainty. A multiobjective fuzzy logic linear goal programming technique is used to find the optimal solution of the problem. Results will be presented with LINDO/GAMS.

3) **Dual-Based Procedures for the Special Case Transshipment Problem**, *R. Raghavendra Sharma*, Indian Institute of Technology, Dept. of IME, Kanpur UP, 208016, India, rrks@iitk.ac.in

Two computationally attractive dual-based heuristics were developed for the special case of the transshipment problem and it was found that they both produced solutions within 98% of the optimal solution on average. Solutions of these procedures can be used as advanced starts by the conventional optimization routines.

4) **OR & the America's Cup**, *David F. Shallcross*, Telcordia Technologies, 445 South St., Morristown, NJ 07960, davids@research.telcordia.com

Telcordia Technologies assisted the America One boat in the run-off for the America's Cup race, with boat optimization and strategic planning. I explain how.

5) Multi-Objective Optimization of the Transportation Network with the Application of the Genetic Local Search, Jacek Zak, Poznan University of Technology, 3 Piotrowo St., Poznan, 60-965, Poland, jacek_zak@ilim.poznan.pl, **Andrzej Jaskiewicz, Pawel Kominek**

The multi-objective VRP is considered. The transportation network of the passenger transportation company, operating in the western part of Poland, is optimized. Several important criteria for both passengers and operators are taken into consideration. An efficient metaheuristic algorithm known as local search is applied to solve the problem.

MB18 The Use of (Reliance on) Spreadsheets to Management Science Concepts

Sponsor: INFORM-ED

Sponsored Session

Chair: John A. Lawrence, California State University, Dept. of MS/IS, Fullerton, CA 92634, jlawrence@fullerton.edu

1) The Spreadsheet Debate, John A. Lawrence, California State University, Dept. of MS/IS, Fullerton, CA 92634, jlawrence@fullerton.edu

Because most students have Excel and using Excel supports training in other functional areas, many have seen the use of spreadsheets as rejuvenating a threatened course in many business schools. However, many have found that using dedicated software allows for more time to analyze and develop models. The debate? What is the most effective way to deliver the introductory MS course.

2) Using Spreadsheets Improves Business Student Learning, Thomas A. Grossman, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, grossman@ucalgary.ca

Business students are training to be general managers, not OR/MS experts. They must be taught modeling before OR/MS tools. Because they can't use algebra to do modeling, they lack access to and comprehension of algebraic tools. Spreadsheet modeling makes them better managers and gives them genuine access to OR/MS.

3) Spreadsheet-Based Management Science: An Integrative Environment, Jeffrey D. Camm, University of Cincinnati, QAOM Dept., ML 0103, Cincinnati, OH 45221-0130, jeff.camm@uc.edu

There are many good reasons to use spreadsheets in teaching MS. We will discuss these, with special emphasis on the fact that it is the spreadsheet environment that allows students to most easily integrate the tools of MS.

4) The Case Against a Strong Reliance on Spreadsheets, Jim Burns, Texas Tech University, Coll. of Bus. Admin., Lubbock, TX 79409-2101, jimburns@ttu.edu

Spreadsheets were designed to enable fast recalculation of arrays of numbers. They are not such good devices for modeling, however, because they do not convey the structure of the model to the user; they do not openly reveal the equations or relations that comprise the model.

5) The Case for using Dedicated Management Science Packages, Yih-Long Chang, Georgia Institute of Technology, 222 North Ave., Atlanta, GA 30332, yihlong.chang@mgt.gatech.edu

I will discuss the idea of developing an MS package. The advantages and difficulties are also discussed.

MB19 Telecommunications II

Contributed Session

Chair: Tony Cox, Cox Associates, 503 Franklin St., Denver, CO 80218, tony@cox-associates.com, http://cox-associates.com/

1) A GRASP Heuristic in Solving a Generalized Local Access Network Problem, Bernard T. Han, Western Michigan University, Dept. of BIS, Kalamazoo, MI 49008, bernard.han@wmich.edu

We present a metaheuristic, GRASP, to solve a generalized LAN problem that considers optimally assigning N users to M capacitated network processors. Each processor is bound to 2 capacity constraints. Computational algorithms and results are presented.

2) Analyzing the Development of Local Competition in the Ohio Telecommunications Market using Design of Experiment, Hisham M. Choueiki, PUCO, 180 East Broad St., 3rd Floor, Columbus, OH 43215, hisham.choueiki@puc.state.oh.us

DOE methods will be used to construct an analysis model for assessing the development of local competition in the Ohio telecommunications market. The

factor set that we intend to use includes the geographic location of the switching units, their fiber connectivity and the advanced services that each switching unit is capable of providing.

3) withdrawn - author request of 4/11, Claudia R. Nunes, Instituto Superior Tecnico, Av. Rovisco Pais, Lisbon, 1049-001, Portugal, claudia.nunes@math.ist.utl.pt, **Antonio Pacheco**

4) Predicting how Telecommunications Ads Affect Customer Values, Tony Cox, Cox Associates, 503 Franklin St., Denver, CO 80218, tony@cox-associates.com, http://cox-associates.com/

Advertising and service levels can affect rates at which customers add and drop telecommunications products or vendors. We show how to learn dynamic state-transition models from customer data to describe and predict how ad campaigns and service initiatives affect customer attrition and purchasing behaviors and economic values over time.

MB20 Theory & Applications of Evolutionary Algorithms I

Cluster: Evolutionary Algorithms

Invited Session

Chair: Riyaz Sikora, University of Illinois, 108 Commerce West Bldg., Dept. of Bus. Admin., Champaign, IL 61820, rtsikora@uiuc.edu

1) A Random Keys Genetic Algorithm for a Multiattribute, Nonconvex Cutting Stock Problem, James C. Bean, University of Michigan, Dept. of IOE, 1205 Beal St., Ann Arbor, MI 48109-2117, jbean@umich.edu

In nonconvex cutting stock problems, orders are assigned to stock to minimize production cost. End of reel effects on value are nonconvex in residual length and machine setup has a significant cost. A random keys GA is compared to a MIP on several dimensions.

2) Optimal Crossover & Mutation Rates for the Simple Genetic Algorithm, Gary J. Koehler, University of Florida, Dept. of DIS, 351 Stuzin Hall, Warrington Coll. of Bus., Gainesville, FL 32611, koehler@ufl.edu

The Vose models capture the exact expected behavior of simple GAs. We use these models for a class of problems to find optimal crossover and mutation rates to minimize the expected first passage to target states, such as those populations containing optimal solutions.

3) Distributed Data Mining using Evolutionary Algorithms, Riyaz Sikora, University of Illinois, 108 Commerce West Bldg., Dept. of Bus. Admin., Champaign, IL 61820, rtsikora@uiuc.edu

We present the concepts of distributed learning and simultaneous feature selection in designing more effective and efficient GA-based data mining algorithms.

MB21 Design of Simulation Studies

Sponsor: College on Simulation

Sponsored Session

Chair: Paul Hyden, Cornell University, 206 Rhodes Hall, Sch. of OR/IE, Ithaca, NY 14853-3801, hyden@orie.cornell.edu

1) Simulation Optimization using Iterative Statistical Selection, Soggi Olafsson, Iowa State University, Dept. of IMSE, 2019 Black Engineering Bldg., Ames, IA 50011-2164, olafsson@iastate.edu, **Jumi Kim**

We consider iterative statistical selection methods for solving simulation optimization problems with a large but finite solution space. Several alternative methods are proposed and compared. For each method, we present both proofs of asymptotic convergence and finite time stopping rules. Empirical performances of the proposed methods are also evaluated.

2) Bayesian Methods for Response Surfaces, Stephen E. Chick, University of Michigan, Dept. of IOE, 1205 Beal Ave., Rm. 1777, Ann Arbor, MI 48109-2117, sechick@engin.umich.edu, **Szu Hui Ng**

The development of a multi-stage procedure to identify important factors in simulation experiments is described. Bayesian methods are used to identify the functional form of a response surface. Results are applied to a health care simulation.

3) Linking Model Simulation & Data Collection in Simulation Studies, Michael B. Freimer, Cornell University, 203 Rhodes Hall, Sch. of OR/IE, Ithaca, NY 14853-3801, mfreimer@orie.cornell.edu, **Paul Hyden**

Currently, simulation studies are often viewed as 3 independent stages: data collection, model simulation and analysis and decision making. However, the

need for quick decisions often overwhelms independent analysis of each stage and inevitably sacrifices are necessary. The inherent dependencies between these stages can be exploited to offer effective decisions based on the nature of the resources available...

MB22 Competencies that Promote Technology Leadership

Cluster: Operations & Technology Strategy

Invited Session

Chair: Glen Schmidt, Georgetown University, McDonough Sch. of Bus., G-4 Old North, 37th & O St. NW, Washington, DC 20057, schmidtg@msb.edu

1) **Expansion Options: Strategic Opportunities Created by a Pharmaceutical Research Project**, *Christoph H. Loch*, INSEAD, Blvd. de Constance, Fontainebleau Cedex, 77305, France, christoph.loch@insead.fr, *Kerstin Bode-Greuel*, *Steven Smuck*

The financial value of research projects is difficult to assess because they are highly uncertain. Using an example from a pharmaceutical research project, we develop a decision tree representation of a project. The most important contributor to project value turns out to be the existence of strategic expansion options or the existence of additional decision branches in the tree.

2) **The Impact of Cost Reductions on the Profitability of New Products: Diminishing or Increasing Returns?**, *Ely Dahan*, MIT, Sloan Sch. of Mgmt., 38 Memorial Dr., E56-323, Cambridge, MA 02142, edanan@mit.edu, *V. Seenu Srinivasan*

We show that increasing (not diminishing) returns result from unit cost reduction associated with the development of new products, i.e., the marginal profits due to the second dollar of unit cost reduction are even greater than the marginal profits due to the first dollar of cost reduction.

3) **From Purchaser to Meta-Coordinator: The Transformation of the Supply Chain Manager in the Vertically Disintegrating Firm**, *Geoffrey G. Parker*, Tulane University, Freeman Sch. of Bus., New Orleans, LA 70118, geoffrey.parker@tulane.edu, *Edward G. Anderson*

We propose that as large firms disaggregate into linked chains of smaller firms specializing in specific areas, those smaller firms paradoxically require more highly-skilled generalists, "supply chain coordinators," capable of handling product development, marketing, production and logistics across organizational boundaries. We report case study data to support this hypothesis.

4) **How Paranoid Should You Be? Innovative Competence & Cost Competence Levels Required to Insure Technology Leadership**, *Glen Schmidt*, Georgetown University, McDonough Sch. of Bus., G-4 Old North, 37th & O St. NW, Washington, DC 20057, schmidtg@msb.edu, *Evan L. Porteus*

We examine how paranoid (how competent) an incumbent needs to be to maintain technology leadership. Specifically, we consider innovative competence (the firm's ability to convert a potential new technology into a marketable new product), and cost competence (the firm's relative production cost for that new product).

MB23 Recreational Mathematical Programming

Cluster: Non-Traditional OR

Invited Session

Chair: Michael A. Trick, Carnegie Mellon University, GSIA, Pittsburgh, PA 15213, trick@cmu.edu, <http://mat.gsia.cmu.edu/>

1) **Optimal Card-Collecting Strategies for Magic: The Gathering**, *Robert A. Bosch*, Oberlin College, Dept. of Math., Oberlin, OH 44074, bobb@cs.oberlin.edu

Magic: The Gathering is a fantasy-based card game played by millions in more than 50 countries. Playing the game involves collecting special cards, constructing "decks" of cards and holding "duels" with other players to determine whose decks are superior. We use dynamic programming to derive optimal card-collecting strategies for Magic.

2) **A Flip Analysis**, *Michael A. Trick*, Carnegie Mellon University, GSIA, Pittsburgh, PA 15213, trick@cmu.edu, <http://mat.gsia.cmu.edu/>

Flip is a solitaire board game made by craft woodworkers. We analyze Flip and suggest improvements to the rules to make the game more marketable. Variants are easily analyzed by dynamic programming, making this game a good classroom illustration.

3) **Integer Program Modeling of Chessboard Placements & Related Puzzles**, *Martin J. Chlond*, University of Central Lancashire, Lancashire Bus. School, Preston, PR1 2HE, UK, m.

chlond@uclan.ac.uk

A number of chessboard placement puzzles are examined and formulated as IPs. These puzzles require the participant to place pieces on a chessboard according to certain constraints and may be generalized to boards containing any number of squares and pieces displaying properties unfamiliar in the game of chess.

MB24 Empirical Applications of OR Models

Cluster: Data Envelopment Analysis

Invited Session

Chair: Norman Keith Womer, University of Mississippi, Sch. of Bus. Admin., University, MS 38677, kwomer@bus.olemiss.edu

1) **Measuring Efficiency with a Linear Economic Model**, *Norman Keith Womer*, University of Mississippi, Sch. of Bus. Admin., University, MS 38677, kwomer@bus.olemiss.edu, *Homee F. E. Shroff*, *Thomas R. Gullede*, *Kingsley E. Haynes*

We modify and interpret DEA using a linear economic model. This approach is similar to cone input/output and assurance region approaches to DEA, but it is implemented so that the multipliers are measured in the same units across all linear optimization problems. This approach allows us to interpret alternatives as profit maximizing organizations and the DEA multipliers as prices comparable across the alternatives...

2) **Nonparametric Performance Evaluation with Multiple Constituencies**, *M. L. Bouniol*, University of Mississippi, University, MS 38677, mbouniol@olemiss.edu, *Jose H. Dula*, *Norman Keith Womer*

We extend the familiar notion in DEA of nonparametric efficient frontiers to measure relative efficiency of a collection of decision making units to the case when the assessment of some attributes' desirability is a matter of judgement depending on the constituency. Our generalization consists of not defining inputs and outputs specifically but treating the attributes of the units as potentially desirable and undesirable...

3) **The Hearing Center for Applied Enterprise Science**, *Fred W. Glover*, University of Colorado, School of Bus., CB 419, Boulder, CO 80309-0419, fred.glover@colorado.edu, *Gary A. Kochenberger*

To enhance the accessibility of optimization, this Center has been organized to bring its services to enterprises in Mississippi, the Midsouth and the nation through the creation of "resource sharing mechanisms." The "resource" consists of special expertise and software and the "sharing" is accomplished by developing innovative and low cost prototype solutions to enterprise problems...

MB25 Supply Chain Optimization

Sponsor: CPMS

Sponsored Session

Chair: John Milne, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT 05402, jmilne@us.ibm.com

Co-Chair: Grace Lin, IBM Corporation, Tj Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, gracelin@us.ibm.com

1) **Demand Planning with Risk Assessment for Personal Computers**, *Roger R. Gung*, IBM Global Services, Supply Chain Opt., Yorktown Heights, NY 10598, rgung@us.ibm.com, *Jonathan R. Hosking*, *Grace Lin*, *Akira Tajima*

In response to the phenomenal changes of the personal computer market environment, we developed a demand planning system with risk assessment to forecast the demand of building blocks and to analyze various demand scenarios. Different forecasting methodologies and their performance will be discussed.

2) **The Impact of Supplier Flexibility on Inventory & Customer Serviceability**, *Markus Ettl*, IBM Research Division, Tj Watson Research Ctr., PO Box 218, Rte. 134, Yorktown Heights, NY 10598, msettl@us.ibm.com, *Grace Lin*, *David D. Yao*

We consider a supply chain with manufacturers and suppliers where manufacturers are required to make commitments on the quantities purchased by a supplier. The supplier provides flexibility to adjust these quantities. By comparing costs and profits under different scenarios, we examine how supplier flexibility can make better ordering decisions. We illustrate this with numerical examples from the PC industry.

3) **Beware of what You Ask For: Issues in Owning a Large Daily Linear Program People Rely On**, *John Milne*, IBM Microelectronics Division, PROFIT Dept., Essex Junction, VT

05402, jmilne@us.ibm.com, *Chi-Tai Wang*

The IBM Microelectronics Division has developed and deployed a large LP model as part of its supply chain management activities. We will provide an overview of the role of the LP model, its core formulation, the infrastructure in place to support a daily run and ongoing performance improvement efforts.

4) Improving Decision Quality in a Collaborative Environment, *Ying Huang*, IBM, TJ Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, yxh@us.ibm.com

Collaborative decision making between supply chain trading partners has become increasingly common and is considered an important competitive edge if executed properly. We are going to examine the qualitative effects of collaboration on the quality of the trading partner's decision making and discuss possible improvements.

MB26 Locomotive Planning Systems within Railroads

Sponsor: RASIG

Sponsored Session

Chair: Pooja Dewan, BNSF Railway, pooja.dewan@nbf.com

1) Integrating a Locomotive Optimization Model into the Production Environment, *Anshu Pathak*, Canadian National Railway, 935 rue de La Gauchetiere W, Montreal, Quebec, H3B 2M9, Canada, anshu.pathak@cn.ca

We describe the integration of optimization models into production environments and the subsequent changes in data requirements and work processes. The implementation of locomotive distribution model at CN will be described.

2) Estimating the 2001 Locomotive Fleet Size for Norfolk Southern, *Mike Wilson*, Norfolk Southern Railway, 125 Spring St. SW, Atlanta, GA 30303, *Ajith B. Wijeratne*

We describe the process we followed to estimate the number of road locomotives NS will need for 2001. We will describe the model, data and the software used in this study.

3) Implementation of a Real-Time Locomotive Distribution System at BNSF Railway, *Brian D. Roth*, Burlington Northern Santa Fe, Strategic Studies & Analysis, 3017 Lou Menk Dr., Ft. Worth, TX 76131-2830, brian.roth@bnsf.com

We discuss BNSF Railway's ongoing effort to implement a real-time locomotive distribution system based on the locomotive routing model developed by Princeton University. The current status and major difficulties encountered during the experience are described and a summary of the performance of the model relative to historical operations is given.

4) New Approaches for Large-Scale Locomotive Scheduling Problems, *Ravindra K. Ahuja*, University of Florida, Dept. of ISE, 303 Weil Hall, Gainesville, FL 32611, ahuja@ufl.edu, *James B. Orlin*, *Larry Shughart*

We are studying locomotive scheduling problems at CSX Transportation and are focusing on incorporating a variety of practical constraints and business rules. We are developing new integer programming as well as network optimization-based algorithms. We will discuss our progress to date in solving this problem.

MB27 Revenue Management & Booking Control II

Cluster: Pricing & Revenue Management

Invited Session

Chair: Andy Boyd, PROS Strategic Solutions, 3223 Smith St., Ste. 100, Houston, TX 77006, aboyd@proswb.com

1) The Application of Normal Bayesian Hierarchical Models in Airline Forecasting, *Edward L. Kambour III*

We will discuss the topic of Bayesian forecasting using simple hierarchies. Topics will include the implications of applying hierarchical models to passenger data, the mathematical mechanisms involved and computational considerations.

2) Revenue Management Game, *Serguei Netessine*, University of Rochester, Simon Grad. Sch. Bus. Admin., Rochester, NY 14627, netessine@ssb.rochester.edu, ssb.rochester.edu/phdresumes/netessine/, *Robert Shumsky*

Revenue management decisions are not made in isolation but are influenced by the actions of competitors. We examine the impact of competitive behavior on a seat inventory control problem involving 2 airlines and 2 customer classes.

3) Optimal Booking Control for a Single Flight with One Intermediate Stop, *Yuyi Feng*, National University of Singapore, Dept. of IS, Sch. of Computing, Singapore, 119260, Singapore,

fengyy@comp.nus.edu.sg, *Ping Lin*

We consider the booking control problem for a single flight with one intermediate stop. We formulate it as a point process intensity control and obtain the optimal booking control policy exactly. The analysis focuses on characterizing the minimum acceptable fares (MAF) that are used for measuring the intrinsic values of itineraries...

4) Revenue Management for Sporting Events & Concerts, *Jeremy Cohen*, Talus Solutions, jcohen@talussolutions.com, *Dave Levett*, *Robert Phillips*

Sporting events and concerts are characterized by limited capacity, price-dependent demand, multiple seat classes and bookings over time. This makes them natural candidates for revenue management. We describe a methodology for event revenue management and present the results of an application to a baseball franchise.

MB28 Location Models III/SOLA Dissertation Award Winners

Sponsor: Society of Location Analysis

Sponsored Session

Chair: Michael P. Johnson, Carnegie Mellon University, Heinz Sch. of PP&M, Hamburg Hall, Rm. 2108A, Pittsburgh, PA 15213-3890, johnson2@andrew.cmu.edu

1) Integer Programming Approaches to a Multi-Facility Location Problem, *David R. Mazur*, Western New England College, Dept. of Math., Springfield, MA 01119, dmazur@wnec.edu, *Leslie Hall*

We introduce the MFLP which has applications in telecommunications planning problems and study it from the integer programming point of view. Our analysis of the polyhedral structure of subproblems and of the strength of integer programming formulations has led to effective solution approaches to the MFLP.

2) Scenario Planning Approaches to Facility Location: Models & Solution Methods, *Susan Hesse Owen*, General Motors Truck Group, Howal Whiting Bldg., 2500 Centerpoint Blvd., Pontiac, MI 48341-3147, susan.owen@gm.com, *Mark S. Daskin*

No abstract supplied.

3) Subtree Location on Tree Networks Applied to Transportation & Telecommunication Network Design, *James W. George*, Maryland Department of the Environment, 2500 Broening Hwy, Baltimore, MD, jgoerge@mde.state.md.us, *Charles ReVelle*

This dissertation combines location analysis techniques and network design concepts. Methods are developed and tested for optimizing the location of a subtree on a tree network with respect to nodes that are not connected to the subtree. We define a problem-class that does not appear explicitly in the literature.

MB29 Teaching with Spreadsheets

Cluster: Teaching with Spreadsheets

Invited Session

Chair: Chris Albright, Indiana University, Kelley Sch. of Bus., Bloomington, IN, albright@indiana.edu

1) Tactical Issues in Grading Spreadsheet-Based Courses, *Sam L. Savage*, Stanford University, Dept. of MSE, 417 Terman Eng. Ctr., Stanford, CA 94305-4023, savage@stanford.edu

Spreadsheet-based courses require new approaches to grading. Examples of some successful homework problems, exam questions and student projects will be presented, which are based on 15 years of teaching in this environment.

2) A Web-Based Excel Modeling Reference Guide, *Stephen G. Powell*, Dartmouth College, Tuck Sch. of Bus. Admin., 100 Tuck Hall, Hanover, NH 03755, sgp@dartmouth.edu

To effectively build models in Excel, our students need to acquire both a conceptual understanding of MS tools and a facility with Excel. We will demonstrate one approach that uses the Web to provide critical Excel skills and access to advanced tools such as Solver and OptQuest through examples.

3) An Integration of Decision Analysis & Real Options through Spreadsheets, *James S. Dyer*, University of Texas, Dept. of MSIS, CBA 5.202, Austin, TX 78712, j.dyer@mail.utexas.edu

Spreadsheets can be used to build a bridge between the tools of MS and other functional fields, such as finance. We describe the development of a new course in real options that provides a synthesis between the traditional ideas of decision analysis and modern financial theory using spreadsheet models to emphasize implementation and insights. Many of these spreadsheets were developed by

Wayne L. Winston.

4) Testing in Spreadsheet-Based Modeling Courses, Christopher J. Zappe, Indiana University, czappe@indiana.edu

While many faculty find the use of spreadsheets in teaching MS topics quite appealing, some instructors are less confident in dealing with the issue of testing as they implement these innovative teaching strategies. Various suggestions for developing and grading examinations in spreadsheet-based modeling courses will be presented. We will consider appropriate methods of testing across such dimensions as class size, type of course...

MB30 Production-Inventory Systems

Sponsor: MSOM

Sponsored Session

Chair: Saifallah Benjaafar, University of Minnesota, Dept. of Mech. Eng., Minneapolis, MN 55455, saif@tc.umn.edu

1) Joint Production & Pricing Decisions under Production Capacity Constraints, Shiming Deng, University of California, IE/OR Dept., Berkeley, CA 94720-1777, Candace A. Yano

This presentation is concerned with simultaneous production and pricing decisions for a single product with price-sensitive demands under capacity constraints. We discuss the complex interactions between the optimal production schedule and the optimal prices, and show that, counter to intuition, optimal prices do not always increase as capacity decreases.

2) Modeling Multiproduct Shared Kanban & Separate Kanban Systems, John A. Buzacott, York University, Schulich Sch. of Bus., 4700 Keele St., Toronto, Ontario, M3J 1P3, Canada, jbzacot@ssb.yorku.ca, Yves P. Dallery, Bruno Baynat

Consider a production inventory system where multiple products share common facilities. Work flow is controlled by kanban cards. Separate kanban cards can be dedicated to each product; alternatively, kanban cards can be shared by all products produced in a cell. We describe models for analyzing such systems.

3) Optimal Lead-Times Planning in Serial Production Systems with Earliness & Tardiness Costs, Mohsen El Hafsi, University of California, Anderson Grad. Sch. of Mgmt., Riverside, CA 92506, mohsen.elhafsi@ucr.edu

We consider a production system consisting of N processing stages. At each stage, the processing time is a random variable with a known distribution function. The objective is to determine the lead-time to be planned at each processing stage so that the expected total inventory carrying and productivity loss costs are minimized.

4) Is the (Q,r) Model Appropriate for Production-Inventory Systems?, Saifallah Benjaafar, University of Minnesota, Dept. of Mech. Eng., Minneapolis, MN 55455, saif@tc.umn.edu, Joon-Seok Kim

We examine the effectiveness of the conventional (Q,r) model in managing production-inventory systems. We show that for systems with finite capacity, order lead times are highly sensitive to loading and order quantity. Consequently, the choice of optimal order quantity and optimal reorder point can vary significantly from those obtained under the usual assumption of a load-independent lead time.

MB31 The Role of Commitment & Information in a Supply Chain

Sponsor: MSOM

Sponsored Session

Chair: Stephen M. Gilbert, University of Texas, Mgmt. Dept., Grad. Sch. of Bus. Admin., Austin, TX 78712-1174, steve.gilbert@bus.utexas.edu

1) Effective Use & Location of Processing Resources within a Supply Chain, Wendell G. Gilland, University of North Carolina, Kenan Flagler Bus. Sch., CB 3490, McColl Bldg., Chapel Hill, NC 27599-3490, gillandw@bschool.unc.edu

Delayed product differentiation often facilitates customization occurring in distributed facilities located closer to the customer. Queuing theory suggests, however, that multiple, smaller processing centers will require more resources to match response time. We explore the role of demand information in determining the best location and use of processing resources.

2) The Value of Advance-Order Information & Implications for Managing the Supply Chain, Kwaneng Wee, Purdue University, Krannert Grad. Sch. of Mgmt., 1310 Krannert Bldg., West Lafayette, IN 47907, kwaneng_wee@mgmt.purdue.edu, Leroy B. Schwarz, Nicholas C. Petruzzi

We study the value of improved yet imperfect future demand information. We

consider an inventory system in which customers may be viewed as providing "cancellable" advance orders. We determine the optimal inventory policy and provide estimates of the value of using such a system through comparative statistics.

3) Channel Structure & Information Flow for a Product which Integrates Complementary Technologies, Stephen M. Gilbert, University of Texas, Mgmt. Dept., Grad. Sch. of Bus. Admin., Austin, TX 78712-1174, steve.gilbert@bus.utexas.edu, Viswanath Cysa

We examine a situation in which a firm integrates technologies produced by 2 separate upstream firms. In particular, we examine how the distribution of power, i.e., the relative abilities of the 3 firms to commit to wholesale prices or profit margins, influences the flow of information and performance of the channel along a variety of dimensions.

MB32 Tutorial: Constraint-Based Scheduling

Sponsor: Computing Society

Sponsored Session

Chair: Irvin J. Lustig, ILOG, 1080 Linda Vista Ave., Mountain View, CA 94043, ilustig@ilog.com

1) Tutorial: Constraint-Based Scheduling, Wim Nuijten, ILOG S.A., 9 rue de Verdun, Gently, F-94253, France, nuijten@ilog.fr

Constraint-based scheduling is one of the most successful areas of application for constraint programming. We will explain the principles of constraint-based scheduling by modeling several classic scheduling problems and by describing some of the algorithms used internally to solve them. Experimental results as well as comparison to MIP approaches will be given.

MB33 Tutorial: The Spread & Nature of Automated Advisory Services on the Web - Perspectives from dot.com Launch

Cluster: Choice Engineering

Invited Session

Chair: Jan-Peter Lechner, Universität der Bundeswehr Hamburg, FB Wirtschaftswissenschaften, Hamburg, 22039, Germany, jpl@unibw-hamburg.de

1) Tutorial: The Spread & Nature of Automated Advisory Services on the Web: Perspectives from a dot.com Launch, Edward S. Robins, 500 Unicorn Park Dr., Ste. 404, Woburn, MA 01801, erobins@technologyevaluation.com, www.TechnologyEvaluation.com

Automated advisory services (AAS) lends itself naturally to the Web environment. AAS consists of a means of accumulating and cross-referencing data from as many sources as possible to build, populate and refine decision models in as automated a way as possible. A special client version of the tools is then made available (usually for a fee)...

MB34 Technology Management Education for the New Millennium: Challenges & Opportunities

Sponsor: Technology Management Section

Sponsored Session

Chair: Michael K. Badawy, Virginia Polytechnic Institute & State University, PO Box 2931, Merrifield, VA 22116-2931, mbadawy@vt.edu

1) Engineering & Technology Management Education at Portland State University, Dundar F. Kocaoglu, Portland State University, Engineering Mgmt. Program, Portland, OR 97207-0751, kocaoglu@emp.pdx.edu

The Engineering & Technology Management Department at Portland State University is responding to the challenges and opportunities of the new millennium by offering a wide range of degree programs designed to prepare engineers and scientists moving toward leadership positions while maintaining their technical identity. The broad characteristics identifying the department's strategies will be discussed.

2) ENDREA: A National Research School Initiative in Sweden - A Holistic Management of Technology Approach, Dennis Nobelius, University of California, Haas School, Berkeley, CA 94720, nobelius@haas.berkeley.edu

A national research school was launched in Sweden in 1997. This was the first time a holistic and national perspective was taken to the MOT education. Currently, there are 50 PhD students from 4 universities involved. We will elaborate on the experiences gained so far and discuss forthcoming challenges and opportunities.

3) Management of Technology as a Field of Concentration at Rochester Institute of Technology, John E. Etlie, Rochester Institute of Technology, Rochester, NY 14623, jeebbu@rit.edu

We will address some of the issues pertaining to establishing a MOT field of concentration as well as the challenges experienced in creating or constructing a course sequence in MOT.

4) Educational Programs in Management of Technology: Any Road Will Take You?, Jon W. Beard, Southern Illinois University, PO Box 1106, Edwardsville, IL 62026, jbeard@siue.edu

MOT programs have become increasingly popular in recent years. Three challenges characterize the dilemmas facing these programs. First, the concept of technology management is amorphous at best; the curricula vary dramatically and technology, and its effects, are evolving so rapidly that it's a challenge to provide a thorough exploration of current and future relevant issues and concepts...

5) Graduate Curricula in Management of Technology: A Comparative Profile, Michael K. Badawy, Virginia Polytechnic Institute & State University, PO Box 2931, Merrifield, VA 22116-2931, mbadawy@vt.edu

We will identify some of the issues and models implemented in establishing graduate curricula in MOT. Discussion will focus on providing fresh insights and guidelines for further advancing technology management education in order to face the challenges and opportunities provided in the new millennium.

MB35 Software Demonstration III
Software Demo Session

Chair: To be announced

1) Promodel

ProModel is a powerful and flexible software package that allows the optimization of a variety of processes through simulation. It is currently used in industry to plan as well as to improve systems. ProModel is an ideal tool for teaching simulation and is used by major universities across the world.

2) ALPHATECH, Inc., Kendra E. Moore, ALPHATECH, Inc., 50 Mall Rd., Burlington, MA 01803, kem@alphatech.com, **Jack C. Chiang**

ALPHA/Sim is a general purpose, discrete-event simulation tool based on Petri nets. The graphical modeling environment provides a simple yet powerful set of model building blocks, making it easy to learn and use productively. Single-user, site and educational licensing available. Platforms include PCs (NT) and Sun Workstations (SunOS or Solaris). ALPHATECH offers training, consulting and technical support.

Monday 13:00-14:00

MP36 Plenary: On Doing Well by Doing Good
Plenary Session

Chair: To be announced

1) Invited Plenary: On Doing Well by Doing Good, Robert E. Woolsey, Colorado School of Mines, Dept. of Math & Comp. Sci., Golden, CO 80401

We outline the Applied OR program at the Colorado School of Mines as of December 1999. Now in its 29th year of operation, the program boasts more than 300 graduates around the world. The program focuses first and foremost on real-world application. All students are required to complete one or more real-world Pro Bono Publico projects in the public or private sector. Those students who, before or after graduation, have done projects that save in excess of \$1,000,000 in one calendar year are awarded a diamond stickpin. At present, current and former students have generated verified savings in excess of \$267,614,918. Letters of verification for the previous number will be presented and the projects discussed. Further, we have a placement rate, within 6 months of graduation, in excess of 98% over 29 years. This presentation will tell how we did it and how you could, too.

Monday 14:15-15:45

MC01 Panel: The Future of Decision Analysis Software
Sponsor: Decision Analysis Society
Sponsored Session

Chair: Don N. Kleinmuntz, University of Illinois, Dept. of Bus. Admin., MC 706, 1206 South Sixth St., Champaign, IL 61820, dnk@uiuc.edu

1) Panel: The Future of Decision Analysis Software, James S. Dyer, University of Texas, Dept. of MSIS, CBA 5.202, Austin, TX

78712, j.dyer@mail.utexas.edu, **Donald L. Keefer**, Arizona State University, Dept. of Mgmt., Tempe, AZ 85287, don.keefer@asu.edu, **Ralph L. Keeney**, University of Southern California, 101 Lombard St., Ste. 704W, San Francisco, CA 94111, keeneyr@aol.com, **James E. Smith**, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, jes9@mail.duke.edu, **Terry Reilly**, Babson College, Math & Sci. Div., Babson Park, MA 02457-0310, reilly@babson.edu

We will address the current state and future potential of decision analysis software. A panel of knowledgeable decision analysts will address such questions as: "What features or enhancements would add the most value?" and "What is the appropriate role for software in decision analysis applications?" Audience participation is encouraged.

MC02 Decision Support Systems
Contributed Session

Chair: Marc Kilgour, Wilfrid Laurier University, Dept. of Math, 75 University Ave., Waterloo, Ontario, N2L 3C5, Canada, mkilgour@wlu.ca

1) A Large-Scale Model for Governmental Tax Policy Planning, Art R. Warburton, Simon Fraser University, Fac. of Bus. Admin., Burnaby, BC, V5A 1S6, Canada, warburto@sfu.ca, **Anil Gupta**

Government personal income tax policy planners face a formidable task when attempting to determine if current and proposed tax policies will achieve their intended objectives. To aid the planners in their task, we have developed a detailed, large-scale, multi-period, multi-objective optimization model of Canada's personal income tax system.

2) The Design & Implementation of a Physician Curing Information System using Evidence-Based Medicine, Herbert S. Diamond, Western Pennsylvania Hospital, Dept. of Medicine, 4800 Friendship Ave., Pittsburgh, PA 15224, hdiamond@ixnetcom.com, **Michael P. Johnson, Rema Padman**

Many health care providers and insurers are adopting treatment standards derived from evidence-based medicine. We present the design and a preliminary prototype of a DSS intended to provide physicians, staff and patients with...

3) A Decision Support System for Interactive Decision Making: Input Overview, Marc Kilgour, Wilfrid Laurier University, Dept. of Math, 75 University Ave., Waterloo, Ontario, N2L 3C5, Canada, mkilgour@wlu.ca, **Liping Fang, Keith W. Hipel, Xiaoyong Peng**

A comprehensive DSS, GMCR II, facilitates the systematic study of real-world interactive decision problems. We provide an overview of GMCR II's model formulation subsystem which utilizes specially designed data structures and new algorithms to construct and manage efficient, flexible and complete graph models of strategic conflicts.

MC03 Verification, Validation & Accreditation of Models & Simulations

Sponsor: Military Applications Society
Sponsored Session

Chair: Priscilla A. Glasow, The MITRE Corporation, MS W626, 1820 Dolley Madison Blvd., McLean, VA 22102, pglasow@mitre.org

1) Acceptability Criteria for Joint Conflict & Tactical Simulation Use for Military Operations in Urban Terrain Studies, Andy Bowers, The MITRE Corporation, Joint Warfighting Ctr. Site, Fenwick Rd., Bldg. 96, Ft. Monroe, VA 23651-5000, bowersa@mitre.org

The Joint Staff J8 intends to use JCATS to analyze MOUT in support of the Quadrennial Defense Review 2001. To comply with Joint Staff Instruction 8104.01, JCATS must first be accredited for such use. We discuss the development of acceptability criteria and propose criteria in 4 categories.

2) Verification & Validation of the Aircraft Readiness Model, Randy Riddle, IIQ AFOTEC/TSE, 8500 Gibson Ave. SE, Albuquerque, NM 87117, riddler@afotec.af.mil, **Andrew E. Coop**

We provide an overview of a pilot model verification and validation effort. The ARM 1.1 is a proof-of-concept aircraft availability model built in MODSIM II, a programming language by CACI Products Co. The model is a discrete-event simulation in an object-oriented framework, very different in program structure and operation from the queueing models historically used to estimate aircraft availability...

3) Recent Applications of DoD Verification, Validation & Accreditation Policy & Recommended Practices, Priscilla A. Glasow, The MITRE Corporation, MS W626, 1820 Dolley Madison

Blvd., McLean, VA 22102, pglasow@mitre.org

We will examine some recent applications of the DoD policy governing VV&A of models and simulations. The examples discussed will explore how existing DoD policy and recommended practices are being used to plan and execute current VV&A efforts.

MC04 Undergraduate OR/MS Project Showcase I Invited Session

Chair: Mark R. Parker, USAF Academy, 2354 Fairchild Dr., Ste. 6D2AF Academy, CO 80840, mark.parker@usafa.af.mil

1) Quantifying the Saint's Cattle Company's Ranch in Montana, *Mark R. Parker*, USAF Academy, 2354 Fairchild Dr., Ste. 6D2A, USAF Academy, CO 80840, mark.parker@usafa.af.mil

Using various OR/MS techniques, such as Markov processes, LP, decision trees and forecasting, we are able to model different aspects of a typical ranch environment. Our scenarios include cattle herd management, forecasting, diversification of livestock and estate planning.

2) Search & Rescue Strategies, *Christopher Lloyd*, US Military Academy, Dept. of Math. Sci., West Point, NY 10996-1786, *Jeremy Singleton*

We simulated and investigated 3 general search-and-rescue scenarios to determine the most effective method of searching in order to maximize the probability of finding isolated personnel. The team simulated a Markovian, a semi-Markovian and a non-Markovian scenario, approximating conditions of desert- and water-borne searches.

3) Design of Lightweight, Rapidly Deployable Combat Systems, *Robert Gordon*, US Military Academy, Dept. of Math. Sci., West Point, NY 10996-1786, *William Oehrich*

In order to rapidly deploy and operate effectively in the 21st century, future combat systems must weigh less, while maintaining lethality, survivability, sustainability and mobility. Thus, the goal of our capstone research was to design a lightweight, rapidly deployable future combat system(s) that is lethal, survivable and efficient.

4) A Combat Simulation Facility for Cadets, *Nicholas Armstrong*, US Military Academy, Dept. of Math. Sci., West Point, NY 10996-1786, *Matthew McDonough*

We designed a technologically advanced combat simulation facility to enrich the military education and training of cadets. The design team will present the recommended alternative, the analysis behind the recommendation and the project plan for implementation.

MC05 Scheduling II

Cluster: Scheduling
Invited Session

Chair: Chung-Yee Lee, Texas A&M University, 238 Zachry Bldg., Dept. of IE, College Station, TX 77843, cylee@acs.tamu.edu

1) Supply Chain Scheduling: Sequence Coordination, *Nicholas G. Hall*, Ohio State University, Dept. of MS, 2100 Neil Ave., Columbus, OH 43210-1144, hall.33@osu.edu, *Alessandro Agnetis*, *Dario Pacciarelli*

We study sequence coordination issues within supply chains. We provide algorithms to minimize supplier's and manufacturer's interchange and WIP cost and identify paths between the 2 optimal sequences. We describe algorithms and complexity results for minimizing total system cost. Incentives for collaboration and extensions to larger chains are discussed.

2) Subproblem Prioritization in Decomposition Methods for Job Shop Scheduling, *Haldun S. Aytug*, University of North Carolina, Belk Coll. of Bus., Charlotte, NC 28223, haytug@email.uncc.edu, *Karl Kempf*, *Reha Uzsoy*

We develop alternative means of prioritizing subproblems for decomposition methods for job shop scheduling problems. Greedy methods and beam search variants are compared in computational experiments and insights into problem structure are discussed.

3) Process Planning & Production Scheduling of Satellite Propulsion Systems, *Mark Fleischer*, University of Maryland, Inst. for Systems Research, College Park, MD 20742, *Jeffrey W. Herrmann*

Integrated process planning and production scheduling will be an important tool to next-generation product development processes. We describe the issues and possible approaches for developing a system that dynamically creates process plans and schedules for the assembly, integration and testing stages of custom

satellite propulsion systems.

4) The Use of Flowlines to Simplify Routing Complexity in Two-State Flowshops, *George L. Vairaktarakis*, Case Western Reserve University, Weatherhead Sch. of Mgmt., 10900 Euclid Ave., Cleveland, OH 44106-7235, gxv5@guinness.som.cwru.edu, *Mohsen El Hafsi*

We present heuristic algorithms for FMSs supported by automated material handling devices and report their optimality gaps. We show that the decomposition of 2-stage flowshops with complicated routing into flowline-like designs with unidirectional routing is associated with minor losses in throughput performance, resulting in significant savings in material handling costs.

5) Just-in-Time Scheduling for a Dynamic Job Shop, *Michael X. Weng*, University of South Florida, 4202 East Fowler Ave., Tampa, FL 33620

We discuss the problem of scheduling a dynamic jobshop so as to minimize total job earliness and tardiness. A variety of job dispatching rules and job due date assignment policies will be examined and simulation results discussed.

MC06 Panel: Workforce Scheduling in Call-Centers - Bridging Theory & Practice

Cluster: Service Design
Invited Session

Chair: John C. Goodale, Ball State University, Dept. of Mgmt., Coll. of Bus., Muncie, IN 47306, jgoodale@bsu.edu

1) Panel: Workforce Scheduling in Call-Centers - Bridging Theory & Practice, *Chris C. Colgan*, American Express Financial Advisors, 4315 South 2700 West, Salt Lake City, UT 84184, chis.c.colgan@aexp.com, *Chris C. Dunn*, Salt Lake City Police Department, 315 East 200 South, Salt Lake City, UT 84111, chris.dunn@ci.sl.c.ut.us, *Fred F. Easton*, Syracuse University, Brethren Operations Mgmt. Inst., Sch. of Mgmt., Syracuse, NY 13244, ffcaston@syr.edu, *Larry W. Jacobs*, Northern Illinois University, Op. Mgmt. & IS Dept., de Kalb, IL 60115, jacobslw@wpo.cso.niu.edu, *Gary M. Thompson*, Cornell University, Sch. of Hotel Admin., Ithaca, NY 14853, gmt1@cornell.edu

With unemployment rates hovering near record lows, effective and efficient use of high-quality workers has never been more challenging for call-center managers. We will explore these key operational issues and propose research agendas that will help meet these challenges.

MC07 Operations Management II

Contributed Session

Chair: Alan Scheller-Wolf, Carnegie Mellon University, GSIA, Pittsburgh, PA 15213, awolf@andrew.cmu.edu

1) Cycle Time as Estimated by Little's Law: A Simulation Study of the n-Job, m-Machine Job Shop Environment, *Brian D. Neureuther*, Gardner-Webb University, Broyhill Sch. of Mgmt., Boiling Springs, NC 28017, bneurether@gardner-webb.edu, *George N. Kenyon*, *Jim Burns*

The development of Little's Law has been shown to give relatively precise and replicable estimates of the true cycle time in a variety of production systems. We compare the expected cycle time as computed by Little's Law to the actual cycle time determined from simulation analysis in single and multiple product, multiple operation semiconductor fabrication systems.

2) Distribution Channel Design in Supply Chains, *Don Q. Yao*, University of Wisconsin, Sch. of Bus., Milwaukee, WI 53201, dyao@csd.uwm.edu, <http://www.uwm.edu/~dyao>, *John J. Liu*

The manufacturer's decision to sell directly to end users has been the most controversial issue in supply chain reengineering. Many observers predict that e-commerce will lead to disintermediation. However, some others just view the Internet as one more distribution channel. We will set up a dynamic control model and analyze whether the company can benefit from opening a direct channel.

3) Aircraft Spares Optimization: Simulation Supports Airline Maintenance, *Richard Cobb*, Jacksonville State University, 224 Merrill Hall, CCBA, Jacksonville, FL 36265, rcobb@jsucc.jsu.edu

The dynamic nature of the airline maintenance function necessitates the use of flexible and reliable decision techniques. This research demonstrates how simulation, a proven OR tool, can be an aid to managers faced with the problem of accurately forecasting the probability of a stockout while carrying various levels of inventory.

4) Inventory Models with Expedited Ordering: Policies,

Solutions & Heuristics, Alan Scheller-Wolf, Carnegie Mellon University, GSIA, Pittsburgh, PA 15213, awolf@andrew.cmu.edu, *Uday S. Rao*

We examine a system with regular and expedited replenishment over an infinite horizon. As optimal policies are complex, we evaluate different order-up-to policies as heuristics. We find optimal parameters for one policy class with backorders and provide heuristics for a second type of policy or when there are lost sales.

MC08 Quality Regulation in Manufacturing & Service

Sponsor: Applied Probability Society
Sponsored Session

Chair: John J. Liu, University of Wisconsin, Sch. of Bus., Milwaukee, WI 53201, jjl@uwm.edu

1) **Integrated Inspection Review for Excursion Monitoring & Baseline Reduction, Ram Akella,** Stanford University, Dept. of EES & OR, Terman Engineering Ctr. 311, Stanford, CA 94305-4023, akella@leland.stanford.edu, *Chih-Hung Lin, Kristin Fridgerisdottr*

We develop a novel methodology to achieve an integrated inspection-review strategy with significant semiconductor facility impact and touch upon baseline reduction. Using multi-dimensional SPC charts, we integrate excursion detection and source identification scheduling and evaluate the impact of throughput rate and classification accuracy on the resulting economic benefits from a semiconductor fab economic perspective.

2) **Decentralized Quality Control, Engelbert J. Dockner,** University of Vienna, Dept. of Business, Bruennerstrasse 72, Wien, A-1210, Austria, dockner@finance2.bwl.univie.ac.at, *Alfred Luhmer*

In modern quality management, the focus has changed from utilization of a given production system to enhancing the system's ability for rapid improvements. However, upgrading the quality performance of a system requires investments. Decisions on these investments are closely related to decisions on current operations of the same system which enter the dynamic economic problem...

3) **Data-Warehouse & BI: Control our Data Quality, Minghui Yang,** Boeing Commercial Airlines Group, Stats & Decision Support ALS, 17930 Pacific Hwy, MS 36-40, Seattle, WA 98104, minghui.yang@pss.boeing.com

Data-warehouse has become a hot topic in the BI and decision support areas. Many database and software companies have put great effort into helping their customers build data-warehouses and developing both OLTP and OLAP tools. But compared with other areas in software engineering and database applications, data-warehouse has not been developed as quickly as their founders believe...

4) **Quality Regulation in an Assembler-Supplier Chain, John J. Liu,** University of Wisconsin, Sch. of Bus., Milwaukee, WI 53201, jjl@uwm.edu, *Layth C. Alwan*

We consider a 2-level supply chain where a buyer assembles a product with 2 components supplied by 2 suppliers. The buyer sets up a quality target according to market preferences. Through contract terms, the target then translates to 2 sub-targets. The attainment of such targets constitutes a unique differential pursuit of interrelated time-variant targets under stochastic disturbances.

MC09 Logistics of Inventory for Effective Product Management

Cluster: Inventory Management
Invited Session

Chair: Rick Kut C. So, University of California, Grad. School of Mgmt., Irvine, CA 92697, rso@uci.edu

1) **The Effect of Product Variety on Manufacturing Performance, Ziv Katalan,** University of Pennsylvania, The Wharton Sch., OPIM Dept., 1314 SH-DH, Philadelphia, PA 19104-6366, katalan@wharton.upenn.edu, *Awil Federgrun, Guillermo Gallego*

For settings in which all items in the product line are manufactured in a common facility with changeover times and uncertainty, we characterize the growth rate of the optimum cost value among all base-stock policies. To arrive at these growth rates, we develop closed-form bounds for the optimum cost value.

2) **The Impact of Product Substitution on Retail Merchandising, Kumar Rajaram,** UCLA, Anderson Sch., 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095-1481, kumar.rajaram@anderson.ucla.edu, *Christopher S. Tang*

We analyze the impact of product substitution on 2 key aspects of retail merchandising, namely, order quantities and expected profits. To perform this analysis, we extend the basic newsboy model to include the possibility that a product with surplus inventory can be used as a substitute for out-of-stock products.

3) **Excess Inventory & Gray Market Distribution Channels, Scott Carr,** UCLA, Anderson Sch. of Mgmt., Los Angeles, CA 90095, scott.carr@anderson.ucla.edu, *Rachel Yang, Reza Ahmadi*

Issues such as demand uncertainty, production batching and volume discounts may lead to excess inventory and this inventory may be diverted to parallel (or gray market) distribution channels. We study now these channels may be indirectly managed and possibly exploited through supply chain policies.

4) **How does Information Integration Add to the Bottom Line?, Susan Kulp,** Harvard University, Harvard Bus. Sch., Boston, MA 02163, skulp@hbs.edu, *Hau L. Lee, Elie Ofek*

Information integration, in the form of information sharing, synchronized replenishment and collaborative product design and development has been cited as a major source of supply chain improvements. Based on an extensive questionnaire survey, we empirically explore ways in which such integration efforts could add to the profitability of manufacturers of food and consumer products.

MC10 FMS Scheduling

Cluster: Flexible Manufacturing Systems
Invited Session

Chair: Kathryn E. Stecke, University of Michigan, Sch. of Business Admin., 701 Tappan St., Rm. 5206, Ann Arbor, MI 48109-1234, kstecke@umich.edu

1) **Static & Dynamic Scheduling for Flexible Manufacturing Systems having Information Delays, Ashok Kumar,** Grand Valley State University, Seidman Sch. of Bus., 301 West Fulton, Grand Rapids, MI 49504-6495, kumara@gvsu.edu, *Rahul Caprihan, Kathryn E. Stecke*

We present analytical models for static and dynamic scheduling of FMSs in the presence of information delays. Given that such problems are NP-hard in the strong sense, we use simulation to study the impact of such delays in 4 system performance measures: mean tardiness, percent tardiness, mean flowtime and machine utilization.

2) **Scheduling in a Synchronized Flexible Flow Line, Shrikant S. Panwalkar,** University of Wisconsin, Dept. of IOE, 105 Beal Ave., Ann Arbor, MI 48105-2117, spanwalk@engin.umich.edu, *Kathryn E. Stecke*

Flexible flow lines can be found in a number of manufacturing environments. We consider a problem involving daily scheduling of parts of different types on a synchronous flow. In a synchronized line, parts advance to the next station simultaneously. Various situations are analyzed.

3) **A Part Release Scheme in an Identical Multi-Machine Flexible Manufacturing System, Sungchick Kim,** Korea University, Sch. of Eng., Dept. of IE, Anamdong 5th St., Seoul, 136-701, Korea, sungskim@kucn.korea.ac.kr, http://cim.korea.ac.kr, *Choong-Soo Lee*

In recent manufacturing environments, manufacturing orders are characterized by unstable market demands, short product life cycles, varieties of products and short production lead times. In order to fulfill such manufacturing orders, a recent trend in FMS is to utilize versatile machines with fast tool delivery devices.

MC11 Integration of SPC & APC

Sponsor: Quality, Statistics & Reliability
Sponsored Session

Chair: Harriet Black Nembhard, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, hbnem@engr.wisc.edu

Co-Chair: Fugee Tsung, Hkust, Dept. of IE/Em, Clear Water Bay, Kowloon, Hong Kong, season@ust.hk

1) **Model Uncertainty in SPC for Autocorrelated Processes, Daniel W. Apley,** Texas A&M University, Dept. of IE, College Station, TX 77843-3131, apley@tamu.edu

Most SPC methods for closed-loop and autocorrelated processes utilize time-series models to describe the autocorrelation. In practice, such models must always be estimated and are subject to modeling errors, which can have

significant impact on SPC performance. We present a method for quantitatively incorporating model uncertainty information to make SPC performance more robust.

2) Modeling of a Multioperation Process for SPC & APC Integration, Jionghua Jin, University of Michigan, Dept. of IOE, 1927 IOE, Ann Arbor, MI 48109-2117, jhjin@engin.umich.edu, **Yu Ding, Jan Shi**

A state-space model is developed to describe the variation propagation in a multi-station manufacturing process and to correlate this propagation with the in-process measurements. The research provides a solid scientific basis to integrate SPC and APC in the process control problems. Examples from the automotive body assembly will be presented.

3) Multistage Quality Control Combining Statistical Process Control & Automatic Process Control, Fugee Tsung, HKUST, Dept. of IE/EM, Clear Water Bay, Kowloon, Hong Kong, season@ust.hk

As manufacturing quality has become a decisive factor in global market competition, quality control techniques such as SPC and APC are becoming popular in industries. With advances in information, sensing and data capture technology, large volumes of data are being routinely collected and shared over multiple-stage processes, which have growing impact on the existing SPC and APC methods...

4) Cuscore Designs for Monitoring Feedback Control Schemes, Harriet Black Nembhard, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706-1572, hbnem@engr.wisc.edu, **Rene Valverde-Ventura**

We study the monitoring of a process subject to feedback control using Cuscore designs. One criticism of feedback control is that it may cancel out signals that are due to a special cause. We use Cuscore statistics to discover signals for a spike, bump, step change or exponential increase that are hidden in an ARIMA (p,d,q) noise...

MC12 Stochastic Decision Processes

Cluster: Dynamic Programming

Invited Session

Chair: Emmanuel Fernandez-Gaucherand, University of Arizona, SIE Dept., Tucson, AZ 85721-0020, emmanuel@sie.arizona.edu

1) A Probabilistic Analysis of Bias Optimality in Uni-Chain Markov Decision Processes, Mark E. Lewis, University of Michigan, IOE Dept., 1205 Beal Ave., Ann Arbor, MI 48109-2117, melewis@engin.umich.edu, **Martin L. Puterman**

We study bias optimality in uni-chain Markov decision processes. A probabilistic approach is used to give intuition as to why a bias-based decision maker

2) Transformations of Constrained Multi-Armed Bandit Problems & Implications, Michael N. Katehakis, Rutgers University, 180 University Ave., Newark, NJ 07102, **Apostolos N. Burnetas**

Consider a dynamic allocation problem with side constraints. We develop an equivalent unconstrained Markov decision process model and show that there is a 1-to-1 correspondence of the optimal policies between the 2 problems. We discuss implications of the transformation of constrained adaptive decision processes.

3) Risk-Sensitive Markov Decision Processes: Average Criteria, Rolando Cavazos Cadena, UAAAN, Buenavista, 25315 Saltillo Coah, Mexico, rcavazos@uaaan.mx, **Emmanuel Fernandez-Gaucherand**

We review several recent results concerning Markov decision processes with risk, i.e., variance, sensitive average criteria. Optimality equations, vanishing discount schemes and counter-examples are discussed.

4) Decision-Theoretic Troubleshooting in Telecommunication Systems: Risk-Sensitive Models, Mark A. Shayman, University of Maryland, ECE Dept., Inst. for Systems Research, College Park, MD 20742, shayman@eng.umd.edu, **Emmanuel Fernandez-Gaucherand**

We consider the problem of determining the optimal sequence of tests for the discovery of a faulty component in a telecommunications network, where there is a random cost associated with testing a component. The main feature that differentiates our work from the available literature in this field is our choice of optimality criteria used to rank competing schedules...

MC13 Heuristics for Large-Scale Combinatorial Problems I

Cluster: Search in Combinatorial & Nonlinear Optimization

Invited Session

Chair: Bahram Alidaee, University of Mississippi, Ctr. for Enterprise Sci., School of Bus. Admin., University, MS 38677, balidaee@bus.olemiss.edu

1) Distributed Genetic Algorithms for Training Neural Networks on Large Databases for Data Mining Applications, John D. Johnson, University of Mississippi, Ctr. for Enterprise Sci., School of Bus. Admin., University, MS 38677, jjohnson@bus.olemiss.edu, **Tabitha L. James, Bahram Alidaee**

Message passing interface is used on a LINUX cluster to implement both fine and coarse grain parallel neural networks. The fine grain problem involves dividing the vector dot product calculations for the feed forward networks across multiple machines. This is done to solve the computational problem on large databases...

2) Penalty Scatter Search: A New Evolutionary Meta-Heuristic for Multi-Resource Generalized Assignment Problems, Mohammad M. Amini, University of Memphis, MIS/DS Dept., Memphis, TN 38152, aminim@cc.memphis.edu, **Fred W. Glover, Gary A. Kochenberger**

Scatter search and path relinking have been shown to be effective approaches for solving difficult problems in discrete and nonlinear optimization. We present a penalty scatter search metaheuristic to solve the multi-resource generalized assignment problem with many applications in the areas of logistics and telecommunication. Computational results on a variety of test problems are discussed.

3) Applications of Binary Quadratic Programming, Gary A. Kochenberger, University of Mississippi, Ctr. for Enterprise Sci., Sch. of Bus. Admin., University, MS 38677, gkochenberger@bus.olemiss.edu, **Fred W. Glover, Bahram Alidaee, Mohammad M. Amini**

Exact penalties were proposed many years ago for transforming constrained 0-1 models into equivalent unconstrained quadratic models. With the exception of some graph-related problems, however, few applications of such transformations have been reported in the literature. We revisit this notion and present a variety of applications. Considerable computational experience is discussed.

4) One-Pass Algorithms for Binary Quadratic Programming, Bahram Alidaee, University of Mississippi, Ctr. for Enterprise Sci., School of Bus. Admin., University, MS 38677, balidaee@bus.olemiss.edu, **Fred W. Glover, Gary A. Kochenberger, Mohammad M. Amini**

We present several 1-pass heuristics for binary quadratic programming problems. Computational results for large-scale problems up to 12000 variables will be presented.

MC14 Tutorial: Stochastic Integer Programming

Cluster: Stochastic Programming

Sponsor: Optimization Section

Sponsored Session

Chair: Chanaka Edirisinghe, University of Tennessee, MS Program, 610 SMC, Knoxville, TN 37996, chanaka@utk.edu

1) Tutorial: Stochastic Integer Programming, Suvrajeet Sen, University of Arizona, Dept. of SIE, Tucson, AZ 85721

The fields of stochastic and integer programming have seen major advances in the last decade. These areas are now mature enough that a much larger class of problems, namely stochastic integer programs, can be addressed in the new millennium. This tutorial will present an overview of IP results that seem to be most relevant to the solution of SIP problems.

MC15 Cone-Linear Optimization

Cluster: Linear Programming/Complementarity

Sponsor: Optimization Section

Sponsored Session

Chair: Tamas Terlaky, McMaster University, Dept. of Computing & Software, Office JHE/214, Hamilton, Ontario, L8S 4L7, Canada, terlaky@cas.mcmaster.ca

1) Strong Duality in Geometric Optimization using a Conic Formulation, Francois Glineur, Faculte Polytechnique de Mons, Service Math et RO, 9 rue de Houdain Mons, Belgium, B-7000,

Belgium, francois.glineur@fpms.ac.be

Geometric optimization can be cast as a convex problem with an interesting strong duality property: the optimum duality gap is equal to 0. We formulate this problem as a primal-dual pair using a dedicated convex cone, which allows us to derive this strong duality property easily.

2) Continuous Trajectories for Potential-Reduction Methods, Reha H. Tutuncu, Carnegie Mellon University, 6113 Wean Hall, Dept. of Math Sci., Pittsburgh, PA 15213, reha@andrew.cmu.edu

Convergence behavior of primal-dual trajectories of certain families of vector fields is studied. These vector fields arise from potential-reduction directions for the Tanabe-Todd-Ye potential-function for LP problems. The asymptotic behavior of the resulting trajectories is analyzed and their relation to algorithms is discussed.

3) A Study on Polynomial Convex Barrier Functions, Jiming Peng, Delft University of Technology, ITS/TWI/SSOR, Mekelweg 4, Delft, 2628 CD, The Netherlands, j.peng@its.tudelft.edu, **Cornelis Roos, Tamas Terlaky**

Various potential functions have been used in the design and analysis of interior point methods. Usually, these functions are driven from a barrier function of one variable with some desirable properties. Most barrier functions in the IPM literature are related to the logarithmic barrier function. Here, a new class of barrier functions is introduced. Their growth behavior and barrier property will be discussed...

4) Almost \sqrt{nL} Complexity Large-Update Interior Point Methods, Tamas Terlaky, McMaster University, Dept. of Computing & Software, Office JHE/214, Hamilton, Ontario, L8S 4L7, Canada, terlaky@cas.mcmaster.ca, **Jiming Peng, Cornelis Roos**

A new class of barrier functions was introduced by Peng, Roos & Terlaky in the previous presentation. Interior point methods based on the new barrier functions enjoy better worst-case complexity than known before. The unified analysis preserves the complexity of small-update IPMs while the complexity of large-update IPMs gets $O(n^{\frac{1}{q}+1} \{2q\})$ where q is nonnegative.

MC16 Goods Movement Modeling

Sponsor: Transportation Science Section

Sponsored Session

Chair: Amelia C. Regan, University of California, Engineering Gateway 4151, Dept. of CEE, Irvine, CA 92697-2175, aregan@uci.edu

1) Design of Multi-Mode, Multi-Product Logistics Systems, Karen R. Smilowitz, University of California, Dept. of CEE, 416G McLaughlin Hall, Berkeley, CA 94720-1720, smilo@uclink4.berkeley.edu, **Carlos F. Daganzo**

We study the design and operation of multi-mode transportation networks serving multiple products, where products are defined by level-of-service, i.e., overnight, 2-day delivery, etc. Conventional network design and routing models cannot sufficiently capture the complexity of multi-mode, multi-product networks. We introduce methods to obtain near-optimal solutions with approximations.

2) Solution of an Integrated Freight Network & Input-Output Model, Elaine J. Chang, Northwestern University, Dept. of Civil Eng., 2145 Sheridan Rd., Tech. Inst., Evanston, IL 60208, ejchang@nwu.edu, **S. Travis Waller, Athanasios Ziliaskopoulos, David E. Boyce**

A freight network distribution and assignment model to predict inter-regional demand and link flow is introduced. Specifically, it addresses the fact that demand is affected by the cost of transportation as opposed to being exogenously given. This problem is modeled as an LP that finds the system optimum costs such that freight movements satisfy both final and intermediate demands of all zones...

3) Use & Usefulness of Traffic Information Sources in Commercial Vehicle Operations: The Trucking Industry Perspective, Amelia C. Regan, University of California, Engineering Gateway 4151, Dept. of CEE, Irvine, CA 92697-2175, aregan@uci.edu, **Thomas F. Golob**

We examine how trucking company logistics managers' evaluations of the usefulness of different sources of information about traffic conditions are related to characteristics of the trucking operations they represent using a canonical correlations analysis model. Model data is taken from a survey of nearly 1200 trucking companies with operations in California.

MC17 Transportation Routing

Contributed Session

Chair: Christopher M. Rump, SUNY, Dept. of IE, 405 Bell Hall, Buffalo, NY 14260-2050, crump@eng.buffalo.edu, <http://www.acsu.buffalo.edu/~crump/>

1) withdrawn - author request of 3/21, Matthieu van der Heijden, University of Twente, PO Box 217, Enschede, 7500 AE, The Netherlands, mhe@intro.tno.nl, **Mark J. Ebben**

2) A Labeling Algorithm for Vehicle Routing & Scheduling, Darren D. Hang, HKUST, Dept. of IE/EM, Clear Water Bay, Kowloon, Hong Kong, PR China, hangdj@ust.hk, **Raymond K. Cheung**

We consider a vehicle routing and scheduling problem that is complicated by various practical constraints and operational requirements. A dynamic labeling algorithm is developed and numerical experiments are given.

3) Generalized Distances in Vehicle Routing, Andreas Cardeneo, IFL Universität Karlsruhe, Hertzstrabe 16, Karlsruhe, 76187, Germany, andreas.cardeneo@mach.uni-karlsruhe.de, **Dieter Arnold**

We present a new approach to vehicle routing based on generalized distance measures. In addition to the usual measures for travel cost, we define measures for capacity demand, time windows and structural constraints such as pickup and delivery relations. Experimental results using a commercial software package are presented.

4) Operational-Oriented Aircraft Maintenance Routing, Abdulkadir Sarac, SUNY, IE Dept., Bell Hall, Rm. 342, Box 602050, Buffalo, NY 14260-2050, sarac@eng.buffalo.edu, **Rajan Batta, Christopher M. Rump**

We study daily aircraft routing under a broad set of maintenance requirements along with constraints on labor and slot availability. Due to operational considerations, the problem complexity is at least as great as recent long-term planning oriented studies. To solve this problem, we explore sequential and parallel implementations of a B&P algorithm employing column generation.

MC18 INFORMS Case & Teaching Materials: Dialog with Instructors & Prospective Authors

Sponsor: INFORM-ED

Sponsored Session

Chair: Thomas A. Grossman, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, grossman@ucalgary.ca

1) INFORMS Case & Teaching Materials: A Dialogue with Instructors & Prospective Authors, Thomas A. Grossman, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, grossman@ucalgary.ca

INFORMS Case and Teaching Materials has just been launched to develop and distribute classroom-tested teaching materials for OR/MS, including cases, games and lecture aids. We discuss our offerings and opportunities for case authors and seek input from OR/MS instructors and creators of teaching materials. Our Edelman Prize cases are available at <http://www.informs.org/Pubs/Cases>.

MC19 Environment & Natural Resources

Contributed Session

Chair: Frederick G. Wolf, University of Washington, 3919 77th Ave. Ct. NW, Gig Harbor, WA 98335, fwolf@ato.com

1) Environmental Implications of Multi-Region Power Flows, Robert T. Eynon, US Department of Energy, 1000 Independence Ave. SW, Washington, DC 20585, reynon@eia.doe.gov

We analyze the effects of varying assumptions regarding the multi-region electrical transmission system on emissions of greenhouse gases. The analysis is based on a detailed AC model of the transmission network for the Midwest and Northeast using the PowerWorld model where generator costs and grid operations are addressed.

2) Optimal Waste Management, Ali Elkamel, University of Kuwait, Dept. of Chemical Eng., PO Box 5969, Safat, 13060, Kuwait, elkamel@kuc01.kuniv.edu.kw, **Jadea Al-Shammari, Abdul-Rehman Khan**

A waste management allocation model is presented. Given potential locations of intermediate processing facilities and landfills, locations and capacities of existing facilities, cost structures and quantities of wastes generated at the sources, the model finds out which facilities should be built and how the wastes should be routed, processed and disposed of so the overall cost is minimized...

3) An Optimization Model for Municipal Solid Waste Recycling, Jihh-Shyang Shih, Resources for the Future, 1616 P St. NW, Washington, DC 20036, shih@rff.org, http://www.rff.org, **Garrick E. Louis, Francis C. McMichael**

Under state laws, many municipalities recycle quotas of materials without regard to fluctuating prices. An optimization model is developed for an inventory system that gives municipalities the flexibility to satisfy state mandates while minimizing their net costs of recycling. The results provide guidance for setting local recycling strategies.

4) ORNIM: The Ohio River Navigation Investment Model, Ingrid K. Busch, Oak Ridge National Laboratory, Bldg. 4500N, MS 6270, Oak Ridge, TN 37831-6270, ikx@ornl.gov, **Michael R. Hilliard**

ORNL developed the ORNIM for the US Army Corps of Engineers to allow them to maximize the benefits of the waterway system by selecting investments in construction, rehabilitation and maintenance. It analyzes system-wide benefits, integrates construction and maintenance costs and accommodates a 70-year planning horizon.

5) Accidental Releases of Hazardous Chemicals to the Environment: Normal Accidents & Petroleum Refining, Frederick G. Wolf, University of Washington, 3919 77th Ave. Ct. NW, Gig Harbor, WA 98335, fwolf@ato.com, **Eli Berniker**

In 1984, Perrow proposed the normal accident theory to explain the occurrence of untoward events involving complex and tightly coupled technological systems. We describe an empirical test which operationalized the theory and validated it using a sample of 36 refineries in the western US during the period 1992-97...

MC20 Theory & Applications of Evolutionary Algorithms II

Cluster: Evolutionary Algorithms
Invited Session

Chair: Riyaz Sikora, University of Illinois, 108 Commerce West Bldg., Dept. of Bus. Admin., Champaign, IL 61820, rsikora@uiuc.edu

1) Using Evolutionary Algorithms to Optimize Systems Evaluated via Stochastic Simulation, Justin Boesel, The MITRE Corporation, IST Ctr., OR/Systems Analysis, 1820 Dolley Madison Blvd., McLean, VA 22102, boesel@mitre.org, **Barry L. Nelson**

We propose statistical procedures that allow EAs to be more effective in optimizing stochastic system evaluated discrete-event simulation. Essentially, the procedures pass the randomness from the evaluations along to the selection phase of the EA, which would employ randomness even if the evaluations were deterministic.

2) The p-Median Location Problem & Genetic Algorithms, Sohail S. Chaudhry, Villanova University, Coll. of Commerce & Finance, Dept. of Mgmt., Lancaster Ave., Villanova, PA 19085-1678, chaudhry@ucis.vill.edu, **Shiwei He**

We study a facility location problem in which p facilities are to be located to serve customers such that the aggregate distance traveled is minimized with and without distance constraints between the customers and their closest facility. We show that using a GA as a solution methodology works quite well on a variety of data sets.

3) A Genetic Algorithm for Sustainable Land Management, Derek J. Nalle, Oregon State University, Dept. of Stats., Kidder Hall 44, Corvallis, OR 97331-4606, nalle@stat.orst.edu, **Jeffrey L. Arthur**

The simultaneous objectives of commodity extraction and species sustainability are optimized over multiple time periods. The approach considers all time periods simultaneously, uses individual-specific genetic code whose length varies across individuals, performs some local hill climbing and incorporates ideas borrowed from large-scale problem decomposition.

MC21 Simulation in Production

Sponsor: College on Simulation
Sponsored Session

Chair: David Graehl, Altek Simulations, 2022 East Gyrfalcon Dr., Sandy, UT 84902, davidg@burgoyne.com

1) Simulation as a Factory Operating Tool Establishing Production Pay Targets, Gordon D. Rehn, Deere & Company, One Deere Pl., Moline, IL 61265, gr54556@deere.com

The John Deere August Works sets daily production goals for tractor assembly lines by using simulation. Simulation predicts the expected line output of daily

production lineups dictated by market demand. Simulation results establish the daily production target. Earned wages are determined by comparing actual production achieved vs. this target. We demonstrate this simulation application...

2) Modeling Complex Operator Task Selection using Simulation Language Extensible in Machining & Assembly Environments, Timothy G. Miller, John Deere World Headquarters, Process Engineering, Moline, IL

Modeling the human decision making process within machining and assembly systems can be a significant problem when the operator of a system is responsible for many types of tasks. A process to efficiently model dynamic priorities for operators using intra-object parallelism in SLX will be presented.

3) Plant Management using Simulation

A 10-year-old assembly and paint system is not able to keep up with current production requirements. The system produces more than 31 models, including variations within models. Simulation is used to test modifications to a conveyor system that has 5 miles of track and is also used to train operators in proper system management.

MC22 Information Issues

Cluster: Operations & Technology Strategy
Invited Session

Chair: Laura J. Kornish, Duke University, Fuqua Sch. of Business, Box 90120, Durham, NC 27708-0129, kornish@duke.edu

1) Data Quality & its Impact on Operational Performance in the Retail Setting, Nicole DeHoratius, Harvard Business School, Morgan Hall T10, Boston, MA 02163, ndehoratius@hbs.edu, **Ananth Raman**

The accuracy of retail data is rarely questioned, let alone measured. We examine data quality in the retail setting by identifying the magnitude and the source of data quality problems in the retail operations of a single firm. We also suggest ways to improve data quality, thereby improving service quality.

2) Incorporating Inventory Information into Product Rollover Strategies, Kyle D. Cattani, University of North Carolina, Kenan-Flagler Bus. Sch., Chapel Hill, NC 27599-3490, kyle_cattani@unc.edu, **Gilvan C. Souza**

We present a model for managing inventories at the end of a product's life cycle. We consider 2 basic scenarios: when the existing product is phased out immediately after introduction of the newer generation product and when new and prior generation products coexist in the market for some time.

3) The Role of Middlemen in the Sale of Digital Products, Laura J. Kornish, Duke University, Fuqua Sch. of Business, Box 90120, Durham, NC 27708-0129, kornish@duke.edu

Digital products, those that can be completely delivered to customers in digital format, present new opportunities for producers because they do not have to worry about physical delivery and inventory. We examine the role of the middleman in this new environment.

MC23 Global Efficiency & Benchmarking
Contributed Session

Chair: Gerda Gemser, University of Pennsylvania, Sansom Place East, 3600 Chestnut St., Box 1197, Philadelphia, PA 19104, ggemser@hotmail.com

1) A Case Study using Data Envelopment Analysis, Fernando M. Silva, Instituto Tecnológico de Aeronautica, CTA ITA IEMB, Sao Jose dos Campos, 12228900, Brazil, **Armando Z. Milioni**

Using real data collected in the field, we use DEA to evaluate the efficiency of different plants of a European auto industry, located in different countries. We also use the Windows method to evaluate the evolution of efficiency through time.

2) Redesigning Design Services: A Benchmark Study of Industrial Design Practice in The Netherlands, Germany, Italy, the UK & the US, Gerda Gemser, University of Pennsylvania, Sansom Place East, 3600 Chestnut St., Box 1197, Philadelphia, PA 19104, ggemser@hotmail.com

We compared industrial design practices in the Netherlands with those of leading industrial design firms in Germany, Italy, the UK and the US. The results of our benchmark study indicate that to establish profitable long-term client relationships, firms need to offer either sophisticated specialist services or a full design service.

MC24 Economic Applications**Contributed Session**

Chair: Murat Tarimcilar, George Washington University, 2115 G St. NW, Monroe Hall 403A, Washington, DC 20052, muratt@gwu.edu

1) Analyzing Economic Systems using Computable General Equilibrium Models: The Example of Croatia, Jasminka Sohinger, Faculty of Economics Zagreb, Trg J. F. Kennedy 6, Zagreb, 10000, Croatia, sohinger@efzg.hr, **Irma Adelman**

We illustrate the use of computable CGE models in analyzing the structure of an economic system. For that purpose, we constructed the first CGE model of Croatia implemented in GAMS using the data describing its economy before the country gained independence in 1991.

2) Aligning a Firm's Strategic Goals with its Operational Activities, Tayo G. Fabusuyi, University of Regina, Dept. of Economics, Regina, SK, S4S 0A2, Canada, gbolahan.fabusuyi@mailcity.com

We discuss an approach for aligning an organization's activities and resource allocation with its strategic goals. The approach makes use of an integrated planning process that executives can employ to conceive and implement a creative and coherent strategy.

3) Stability of a Crime Rate Equilibrium, Shou-Jiun Wang, SUNY, 342 Bell Hall, Dept. of IE, Buffalo, NY 14260, sw@eng.buffalo.edu, **Rajan Batta, Christopher M. Rump**

We create a socio-economic model of criminal behavior in which criminals weigh the expected return of a crime against the opportunity cost for committing that crime. Using this model, we explore the dynamic stability of the resulting crime rate equilibrium in response to different levels of enforcement.

4) Cost Allocation in Hub-Like Networks, Darko Skorin-Kapov, Adelphi University, School of Bus., Garden City, NY 11530, skorin@adelphi.edu, <http://www.adelphi.edu/~skorind/>

Hub-like networks arise in a network design problem in which every 2 nodes can communicate directly but there is a monetary incentive to combine flows from different sources. We discuss how to allocate the network cost and/or charge for the network usage in a manner that stimulates cooperation of users.

5) Measuring Bank Efficiency over Policy Changes using a Two-Stage DEA, Mustafa Dinc, The WorldBank Group, 1818 H St. NW, Washington, DC 20433, mdinc@worldbank.org, **Murat Tarimcilar**

We employ a 2-stage DEA to measure the efficiency of banks. It recognizes the dual functionality of the banks, both production and intermediary, and runs a separate model for each role. The impact of major policy changes over the public and private banks, pre- and post-change, were analyzed. Data from 25 years on the Turkish banking system were used to test the model validity.

MC25 Supply Chain Management at IBM

Sponsor: CPMS

Sponsored Session

Chair: Ramesh Srinivasan, IBM, Storage Systems Div., San Jose, CA, sramesh@us.ibm.com

Co-Chair: Grace Lin, IBM Corporation, Tj

Watson Research Ctr., PO Box 218, Yorktown Heights, NY 10598, gracelin@us.ibm.com

1) The Applications of OR in IBM Personal Systems Group Channel Strategy, Rob Allan, IBM, Personal Systems Group, Research Triangle Park, Raleigh, NC

Applications of OR in the Personal Systems Group Channel Strategy teams have included supporting crucial decisions on the number of distribution points in the channel, optimal methods to forecast demand, minimal levels of channel inventory required to meet service requirements and levels of channel assembly. We plan to use OR to support strategy related to international applications...

2) Manufacturing Efficiency & its Effect on Supply Chain Design, John Konopka, IBM Integrated Supply Chain Group, Box 12195, 3039 Cornwallis Rd., MS 307-T18A, RTP, NC 27709, konopka@us.ibm.com, **Susan Rothberg**

We investigate the benefits to a company's supply chain when it improves its manufacturing efficiency. Particular focus will be on final assembly manufacturers and the interactions with their upstream and downstream supply chain partners.

3) Emerging Issues in Data Exchange between Customers & Suppliers, Jay Krishnamurthy, IBM Microelectronics Division,

1000 River Rd., Essex Junction, VT 05452, jaykrish@us.ibm.com

Historically, the interaction between customers and suppliers was limited to placing an order and receiving a commit date. E-business has fundamentally altered this paradigm, imposing significant challenges on supply chain management organizations. We will provide an overview of the challenges presented to the IBM Microelectronics Division and how it has responded.

4) New Opportunities and Challenges in Supply Chain Management at IBM, Ramesh Srinivasan, IBM, Storage Systems Div., San Jose, CA, sramesh@us.ibm.com

Recent developments in Internet software technology make it possible to conduct procurement and fulfillment activities in ways that are dramatically different and with far-reaching opportunities. These developments also bring with them enormous challenges in determining the rate and pace of adoption of new technologies to maintain strategic advantage. These will be illustrated in the context of IBM's supply chains.

MC26 No Session Title Available

Sponsor: RASIG

Sponsored Session

Chair: To be announced

MC27 Pricing & Revenue Management II

Cluster: Pricing & Revenue Management

Invited Session

Chair: Montgomery Blair

, mblair@dollar.com

1) Using Revenue Management for Manufacturing Order Acceptance, Timothy S. Kniker, Analytics, Inc., Kendall Sq., Cambridge, MA, tkniker@hotmail.com, **Mitchell H. Burman**

Revenue management is now being applied to manufacturing in a number of areas. We examine a situation where a production facility with fixed capacity must decide which incoming orders to accept. Unlike previous service industry cases which involved maximizing revenue for discrete events, e.g., a flight, a night in a hotel, a specific advertising slot, etc., profit in this scenario is maximized over a time continuum...

2) Hotel Overbooking Considering Multiple-Night-Stay, Dietrich Chen, Cornell University, 292 Rhodes Hall, Sch. of OR/IE, Ithaca, NY 14853-3801, didi@orie.cornell.edu, **Michael B. Freimer, Peter L. Jackson**

Most overbooking policies in the airline or hotel industry assume single-flight-legs or single-night-stays, respectively. We examine the no-show effects in a multiple-night-stay environment at a hotel. Exact overbooking policies are computationally expensive. Thus, we approximate the solution via heuristics and report numerical results.

3) The Integration of Pricing & Revenue Management, Warren Lieberman, Veritec Solutions, 824 Miramar Terrace, Belmont, CA 94002-2222, warren@veritecsolutions.com

Most revenue management systems focus on optimal inventory control. In the past few years, however, some firms have made significant advances in integrating pricing decision supports into their revenue management programs. We review some recent advances in pricing decision support tools that are integrated in revenue management programs.

4) Asymptotic Properties of Some Revenue Management Problems, William L. Cooper, University of Minnesota, Dept. of Mech. Eng., 111 Church St. SE, Minneapolis, MN 55455-0111, billcoop@me.umn.edu

We describe asymptotic properties of revenue management policies derived from the solution of a deterministic optimization problem. Primary results state that, within a stochastic and dynamic framework, solutions arising out of a single well-known LP can be used to generate policies for which the scaled revenue converges in distribution to a constant upper bound on the optimal value...

MC28 Location Models IV

Sponsor: Society of Location Analysis

Sponsored Session

Chair: Rajan Batta, SUNY, IE Dept., 342 Bell Hall, Box 602050, North Campus, Buffalo, NY 14260-2050, batta@acsu.buffalo.edu

1) Generalized Spatial Interaction Model with Exponential Expenditure Functions, Robert Aboolian, University of Toronto, Rotman Sch. of Mgmt., 105 Saint George St., Toronto, Ontario, M5S 3E6, Canada, **Oded Berman, Dmitry Krass**

We consider locating competitive facilities in a network capturing market share and market expansion where customers' spending is an exponential function of their total utility. We develop a B&B-based piecewise linear upper approximation model to calculate the upper bound. We also develop heuristics and present a worst case analysis.

2) Suitable Access Coverage in the Provision of Public Transportation, Alan T. Murray, Ohio State University, Dept. of Geography, 1036 Derby Hall, Columbus, OH 43210-1361, murray.308@osu.edu, amurray@geography.ohio-state.edu

Public transport service provision is an important component of the overall transportation planning process. Research examining performance characteristics are much needed. Public transport in Brisbane, Australia is evaluated using a commercial GIS integrated with various spatial analytical techniques including a location covering model.

3) Heuristic Solutions to a Facility Location Problem with Stochastic Customer Demand, Qian Wang, SUNY, Dept. of IE, 342 Bell Hall, Buffalo, NY 14260, *Rajan Batta, Christopher M. Rump*

We study the location of service facilities where customer demand follows a Poisson stream and service times are exponential. We assume that every customer travels to his closest facility to receive service. We develop heuristic solution procedures and report on their computational performance.

4) The Weighted One-Center Problem with Arbitrarily-Shaped Barriers, Pavan Nandikota, SUNY, Dept. of IE, 342 Bell Hall, Buffalo, NY 14260, *Rajan Batta, Rakesh Nagi*

We consider the weighted 1-center problem of locating facilities optimally in a 2-dimensional space having arbitrarily-shaped barriers and using Manhattan metric devices. An algorithm is proposed to search for the optimal location. The feasible region is divided into cells which are classified based on the number of cell corners. A procedure to determine the optimal location is established for each class of cells...

MC29 Internet Applications

Contributed Session

Chair: Scott B. Smith, Logistics.com, 22 Third Ave., Burlington, MA 01803, scott_b_smith@logistics.com, www.logistics.com

1) Intelligent Agent for Information Filtering, Dan Zhu, Iowa State University, 300 Carver Hall, Ames, IA 50011, dzhu@iastate.edu

As the Internet's phenomenal growth has become increasingly discernible, information overloading becomes a critical issue. The large volume of unwanted information flooding through the Web presents a serious problem that may affect the productivity in the workforce as well as people's everyday life. We investigate these issues and propose to develop intelligent agents for spam filtering.

2) Applications of Real Options Valuation for Making IT Investment Decisions: An Application in the Managed Health Care Industry, Indranil R. Bardhan, PricewaterhouseCoopers Consulting, One International Pl., Boston, MA 02110, indranil.bardhan@us.pwcglobal.com, *Sandip Patel, Gabriel Bresler, Dan Golosovker, Charles Alsdorf*

We propose the ROV framework to evaluate and prioritize information technology investments under uncertainty. We present a case study, based on a managed healthcare insurer, where the ROV approach was applied to guide senior management to prioritize e-business investments, maximize future growth opportunities and develop an appropriate internet strategy.

3) E-Commerce for Freight Transportation, Scott B. Smith, Logistics.com, 22 Third Ave., Burlington, MA 01803, scott_b_smith@logistics.com, www.logistics.com

Transportation is an important, yet often neglected, component of the supply chain. An electronic, Web-enabled marketplace will facilitate shipper-carrier collaboration. We review some of the opportunities and efficiencies such a marketplace will provide, as well as some challenges in bringing it to reality.

MC30 Incorporating Human Issues into Manufacturing Planning

Sponsor: MSOM

Sponsored Session

Chair: Bryan A. Norman, University of Pittsburgh, 1033 Benedum Hall, Dept. of IE, Pittsburgh, PA 15261, banorman@engr.pitt.edu

1) Incorporating Ergonomics Criteria into Assembly Line

Balancing, Brian J. Carnahan, Auburn University, Dept. of ISE, 207 Dunstan Hall, Auburn, AL 36849, pacarnahan@yahoo.com, *Bryan A. Norman, Mark Redfern*

Three line balancing heuristics, designed to minimize cycle time and the loss of grip strength, were developed. Each algorithm was tested under I- and U-shaped assembly line configurations using 100 problems. Results suggest that evolutionary algorithms and U-shaped configurations allow for line balances that minimize cycle time and physical workload.

2) Human Issues in the Technology Implementation of a Management Simulator, Christopher Chung, University of Houston, Dept. of IE, 4800 Calhoun St., E213-D3, Houston, TX 77204-4812, cchung@uh.edu

We describe the model and development methodology of an interactive training simulator which allows manufacturing managers to develop, test and receive real-time feedback on advanced manufacturing technology implementation strategies and tactics. The simulator allows manufacturing managers to receive this training at low cost and without consequences in compressed time.

3) Modeling the Formation of Effective Worker Teams in Cellular Manufacturing, Ronald G. Askin, University of Arizona, Dept. of ISE, PO Box 210020, Tucson, AZ 85721-0020, ron@sic.arizona.edu, *Yuanshu Huang*

Human issues dominate technical issues when designing and operating manufacturing cells in practice. We propose models for incorporating worker abilities and personality profiles into the design of worker teams for manufacturing cells. Beam search and heuristic search techniques are tested for solving the cell design problem.

4) A Methodology for Assigning Workers to Manufacturing Cells Considering both Human & Technical Skills, Bryan A. Norman, University of Pittsburgh, 1033 Benedum Hall, Dept. of IE, Pittsburgh, PA 15261, banorman@engr.pitt.edu, *Kim L. Needy, Bopaya Bidanda, Rona Colosimo Warner*

We consider the problem of assigning workers to manufacturing cells considering both human and technical skills rather than using technical skills alone. Skills determination, assessment and importance are based on results from working with an industrial partner. We then present efficient solution methodologies for solving the resulting worker assignment problem.

MC31 Supply Chain Contracting & Coordination

Sponsor: MSOM

Sponsored Session

Chair: Yunzeng Wang, Case Western Reserve University, Dept. of OR & Op. Mgmt., WSOM, 10900 Euclid Ave., Cleveland, OH 44106-7235, yxw36@po.cwru.edu

1) Coordinating Inventory & Outbound Transportation Decisions at a Third Party Warehouse, Sila Cetinkaya, Texas A&M University, Dept. of IE, 238 Zachry Bldg., College Station, TX 77843-3131, sila@ie.tamu.edu, *Chung-Yee Lee*

We present an optimization model for coordinating inventory and outbound transportation decisions at a third party warehouse that serves a group of customers located in a given market area. The model presented is considerably different than the existing inventory/transportation model in the literature.

2) Capacity Allocation Issues under Highly Uncertain Demand, Elizabeth C. Junqueira, University of California, Dept. of IE/OR, 4135 Etcheverry Hall, Berkeley, CA 94720-1777, junqueir@ieor.berkeley.edu, *Candace A. Yano*

High technology products have long manufacturing leadtimes, short life cycles and highly uncertain demand. We study capacity allocation and supply commitment decisions facing one supplier of key components with several major customers. The goal is to satisfy supply commitments at minimum cost, while maintaining flexibility to respond to unanticipated changes.

3) Lead-Time Rules in Distributed Manufacturing Systems, Susan Slotnick, Arizona State University West, 4701 West Thunderbird Rd., MC 2451, PO Box 37100, Phoenix, AZ 85069-7100, slotnick@asu.edu, *Matthew J. Sobel*

Consider a system in which a firm of sales representatives procures orders for a manufacturing firm. Specialty steel is one example of such an industry. Our numerical evaluation of alternative lead-time quotation rules, with differing levels of information sharing, builds on previous analytical results.

4) Channel Coordination between a Powerful Retailer & an Informed Manager, John Conlon, University of Mississippi, Sch. of Bus. Admin., University, MS 38677, jconlon@bus.olemiss.edu, *Yunzeng Wang*

We model manufacturer-retailer relationships where the manufacturer knows

more about the state of demand but the retailer has greater bargaining power. We argue that whether the retailer can get the manufacturer to perfectly reveal the state of demand depends on if the retailer knows about the manufacturer's marginal costs.

MC32 Tutorial: Integrating Multiple Mathematical Programming Models in Decision-Making Processes

Sponsor: Computing Society
Sponsored Session

Chair: Agha Iqbal Ali, University of Massachusetts, Dept. of Finance & Op. Mgmt., Isenberg Sch. of Mgmt., Amherst, MA 01003, aiali@som.umass.edu

1) **Integrating Multiple Mathematical Programming Models in Decision-Making Processes**, *Agha Iqbal Ali*, University of Massachusetts, Dept. of Finance & Op. Mgmt., Isenberg Sch. of Mgmt., Amherst, MA 01003, aiali@som.umass.edu

Complex decision-making processes whereby strategic, tactical or operational decisions are made can be resolved, as demonstrated over the past few decades, with appropriate mathematical programming models. Solutions to such models provide options and information that allow decisions to be made in keeping with stated policy and goals...

MC33 Advances in IBM's Optimization Solutions & Library I

Contributed Session

Chair: John Forrest, IBM Research, jforre@us.ibm.com

1) **An Initiative for Open Source Mathematical Programming Software**, *Brenda Dietrich*, IBM Research, dietric@us.ibm.com

As part of IBM's Deep Computing Initiative, we propose an open source model for select mathematical programming software. Advantages over the typical licensing model used by academic institutions are discussed. As examples, we refer to the volume algorithm and parallel B&C framework presentations in this session.

2) **Solving Hard Mixed-Integer Programming Problems with Branch & Cut & Price**, *L. Ladanyi*, IBM, TJ Watson Research Ctr., PO Box 218, Rte. 134, Yorktown Heights, NY 10598, ladanyi@us.ibm.com

BCP is described along with specific applications. First, we introduce BCP, which implements problem independent tasks such as tree management so that users can concentrate on problem-specific aspects of the implementation such as branching strategies. We then discuss several applications.

3) **The Volume Algorithm: Producing Primal Solutions using Subgradients**, *F. Barahona*, IBM Research, barahon@us.ibm.com

We present an extension of the subgradient method called the volume algorithm. In contrast to the traditional subgradient method, the volume algorithm also produces primal solutions. We report computational results for a class of 0-1 problems where the method has done exceedingly well.

MC34 Technology Management: Emerging Issues

Sponsor: Technology Management Section
Sponsored Session

Chair: Dundar F. Kocaoglu, Portland State University, Engineering Mgmt. Program, Portland, OR 97207-0751, kocaoglu@emp.pdx.edu

1) **Knowledge Growth Patterns in Technology Management**, *Halime Inceler Sarihan*, Portland State University, Eng. & Tech. Mgmt. Dept., Portland, OR 97207-0751, halime@emp.pdx.edu, *Dundar F. Kocaoglu*

The Engineering and Technology Management field is continuing to grow. There have been dramatic increases in growth patterns in this field as represented by the number of educational programs, PhD dissertations, research projects, publications and conferences since the mid-70s. We present preliminary observations on the knowledge growth patterns...

2) **Decision-Making Processes in Petroleum Exploration & Development Investments: US Petroleum Companies**, *Razif Abd Razak*, Universiti Teknologi Malaysia, Chemical & Nat. Resources Eng., PO Box 791, Johor Bahru, 80990, Malaysia, razif@fkkksa.utm.my, *Dundar F. Kocaoglu*

Decision-making processes in petroleum E&D investments by oil companies are important steps to ensure the success of potential investments as well as the survival of the companies in the future. We investigate the decision-making processes involved in the identification, evaluation and selection of the investments by oil companies and identify the relationships between such

processes...

3) **A Fuzzy Logic-Based Model for Determining Risk of Exposure from Threats to Internal Controls**, *Margaret F. Shipley*, University of Houston Downtown, Coll. of Bus., 1 Main St., Houston, TX 77002, shipley@dt.uh.edu, *Andre de Korvin*, *Khursheed Omer*

A fuzzy logic-based model addresses the uncertainty of accidental or deliberate threats to internal control measures. The manager's response to these threats is based upon the assessment of risk of exposure from the threat and the resulting expected loss to the company from the damage due to exposure.

MC35 Software Demonstration IV

Software Demon Session

Chair: To be announced

1) **Applied Decision Analysis LLC: Introducing DPL 5.0, Decision Analysis Software**, *Andre Levy*, Applied Decision Analysis LLC, 2710 Sand Hill Rd., Menlo Park, CA 94025, andre.levy@us.pwglobal.com

DPL is professional decision analysis software using influence diagrams, decision trees and spreadsheets. Graphical outputs include rainbow diagrams, risk profiles, policy trees and policy summaries. New in DPL 5.0: time period percentiles, 2-way rainbow diagrams and much more!

2) **Logical Decisions: Improving Group Decision Making with Logical Decisions**, *Gary R. Smith*, Logical Decisions, 1014 Wood Lily Dr., Golden, CO 80401-9228, gary@logicaldecisions.com

Logical Decisions for Windows helps evaluate decisions requiring many evaluation criteria and critical preference and value judgments. LDW's many features and graphic displays make it the most powerful software in its class. The software demonstration will focus on LDW's group capabilities.

Monday 16:00-17:30

MD01 Decision Analysis & Information Systems

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Robin Dillon, Virginia Tech., 7045 Haycock Rd., Ste. 341, Falls Church, VA 22043, dillon@vt.edu

Co-Chair: John Butler, Ohio State University, 2100 Neil Ave., Columbus, OH 43210, butlerj@cob.ohio-state.edu

1) **Comparison of Online Auctions & Name your Price to Yield Management**, *Sam E. Bodily*, University of Virginia, Darden Sch., Box 6550, Charlottesville, VA 22906, bodily@virginia.edu

Revenue (or yield) management has provided tremendous revenue gains for airlines, hotels, rental car companies and many other companies. Online vendor auctions and "name your price" may inexpensively capture consumer surplus and potentially do much better than revenue management. Using probabilistic models, we compare the revenue possibilities of these 3 approaches.

2) **Linking Preference with Information Retrieval**, *John Butler*, Ohio State University, 2100 Neil Ave., Columbus, OH 43210, butlerj@cob.ohio-state.edu

A key assumption for conducting electronic commerce is that the consumer is able to find information that satisfies a set of presumable subjective criteria. We will outline the use of risk value models of preference as the "scoring" mechanism for evaluating and designing consumer searches of the Internet.

3) **Creating a Decision Support System to Support Production Decisions within the Winter Wheat Supply Chain**, *Christopher W. Zobel*, Virginia Tech., MS & IT Dept., 2076 Pamplin Hall, Blacksburg, VA 24061, czobel@vt.edu, *Eluned Jones*

We discuss the development of a computer-based DSS intended to help wheat producers take advantage of opportunities for greater value-added production. Along with a description of the DSS, an explanation of some of the issues concerned with its development will be given.

4) **ROI? Making Information Technology Decisions**, *Robin Dillon*, Virginia Tech., 7045 Haycock Rd., Ste. 341, Falls Church, VA 22043, dillon@vt.edu

Popular business literature is constantly complaining about evaluating IT decisions because the "intangible" benefits of the systems are not captured in an ROI calculation. Is the ROI for information technology decisions an area of application that decision analysis can support?

MD02 Symposium: Studying the Ecological Rationality of Simple Heuristics

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Laura Martignon, Max Planck Institute for Human Development, Ctr. for Adaptive Behavior, Lentzeallee 94, Berlin, 14195, Germany, martignon@mpib-berlin.mpg.de

1) Simple Heuristics & Military Decision Making, Kathryn B. Laskey, George Mason University, Fairfax, VA 22030

No abstract supplied.

2) Adaptive Decision Making, Laura Martignon, Max Planck Institute for Human Development, Ctr. for Adaptive Behavior, Lentzeallee 94, Berlin, 14195, Germany, martignon@mpib-berlin.mpg.de, **Ulrich Hoffrage, Daniel Goldstein**

We present analytical and simulation demonstrations of how 7 features of the environment influence the performance of heuristics for choice tasks using binary cues. The features are: inter-cue correlations, center of gravity of cues, number of cues, discrimination rate (combined with validity), compensatory structure, conditional dependencies between cues and training set size.

3) Simple Heuristics when Driving, Mike Goodrich

No abstract supplied.

MD03 Public Sector Enterprise Resource Planning

Sponsor: Military Applications Society
Sponsored Session

Chair: Rainer Sommer, George Mason University, Policy Analysis Ctr., MS 2E4, Fairfax, VA 22030-4444, rsommer@gmu.edu

1) Enterprise Resource Planning Overview, Thomas R. Gullledge, George Mason University, Inst. of Public Policy, 10640 Page Av, Ste. 400, Fairfax, VA 20124, gullledge@gmu.edu

We describe a public sector implementation strategy for ERP. While considering private sector approaches when appropriate, accommodations are made for the special needs of the government implementation environment. We present the details of the methodology from the perspective of a supporting role in a government ERP program office.

2) Public Sector ERP: Implementation Experiences, Thomas R. Gullledge, George Mason University, Inst. of Public Policy, 10640 Page Av, Ste. 400, Fairfax, VA 20124, gullledge@gmu.edu

We describe our experiences in supporting the ERP implementation in a large DoD organization. We specifically address problems where the implementation methodology was successful and also the sources of implementation difficulties.

3) Requirements Modeling for Public Sector ERP, Rainer Sommer, George Mason University, Policy Analysis Ctr., MS 2E4, Fairfax, VA 22030-4444, rsommer@gmu.edu

We present the models that were used for project scoping and for defining business process requirements for a large DoD ERP implementation. We describe the difficulties of requirements modeling in public sector organizations as well as how the models were successfully used.

MD04 Undergraduate OR/MS Project Showcase II

Invited Session

Chair: Mark R. Parker, USAF Academy, 2354 Fairchild Dr., Ste. 6D2AF Academy, CO 80840, mark.parker@usafa.af.mil

1) Mountain West Conference Men's Basketball Scheduling, Mark McGill, US Air Force Academy, Dept. of Math. Sci., 2354 Fairchild Dr., Ste. 6D2A, USAF Academy, CO 80840, **Shaun Willhite, Richard Seymour, Chris Tomlinson**

The scheduling process for MWC Men's Basketball included enumeration and optimization programming. Our objective was to increase the competitiveness of the conference by avoiding bad schedules. Following work by Nemhauser & Trick for scheduling men's basketball for the Atlantic Coast Conference, we followed a 3-step process of finding feasible schedules.

2) US Air Force Academy Heat Plant Operations, Jason Anderson, US Air Force Academy, Dept. of Math. Sci., 2354 Fairchild Dr., Ste. 6D2A, USAF Academy, CO 80840, **Aaron Torczynski, Michael Lewis, Robert Taylor**

The USAF Academy base heat plant supplies heat to the academic area, the community center area and the hospital using a closed line water system with

heat exchangers. We have determined optimal system settings to minimize operational costs using response surface analysis, sensitivity analysis and an experimental design (DOE).

3) Single- vs. Multiple-Skilled Call Center Representatives, Eddie Francis, US Air Force Academy, Dept. of Math. Sci., 2354 Fairchild Dr., Ste. 6D2A, USAF Academy, CO 80840, **Chris Nielsen, Ben Bennett, Nate Dillon**

Our project focuses on the benefits of training call center representatives to handle multiple types of incoming calls. We used an LP to schedule multiple and single skilled workers to cover incoming calls at a service level specified by the client.

MD05 Scheduling III

Cluster: Scheduling

Invited Session

Chair: Jacek A. Blazewicz, Politechnika Poznanska, Instytut Informatyki, ul. Piotrowo 3a, Poznan, 60-965, Poland

1) Solving Discrete-Continuous Scheduling Problems via Transformation to the Multi-Mode Problem, Joanna Jozefowska, Politechnika Poznanska, Instytut Informatyki, ul. Piotrowo 3A, Poznan, 60-965, Poland, **M. Mika, R. Rozycki, G. Waligora, Jan Weglarz**

We consider the discrete-continuous project scheduling problem. A transformation of this problem to a discrete project scheduling problem in the multi-mode version is presented. A simulated annealing approach to solving this problem is described and tested computationally in 2 versions: with and without finding an optimal continuous resource allocation for the final schedule.

2) Scheduling Trees on Uniform Processors, Wieslaw Kubiak, Memorial University of Newfoundland, Fac. of Bus. Admin., St. John's, NFL, A1B 3X5, Canada, wkubiak@kean.ucs.mun.ca

We consider the problem of scheduling trees of unit execution time (UET) jobs on uniform processors to minimize makespan. We shall review the state-of-the-art for the problem, present recent results on scheduling chains of UET jobs and discuss some open questions.

3) Scheduling Tasks with Relative Timing Constraints on a Single Processor, Klaus H. Ecker, Technische Universität, Inst. f. Informatik, Julius Albert Str. 4, Clausthal, D-38678, Germany, ecker@informatik.tu-clausthal.de

A task model similar to periodic tasks is considered. We deal with infinite chains of tasks where all tasks have the same processing time. To enforce a certain frequency of execution, deadlines relative to the completion times of the processor tasks are defined. This approach offers greater flexibility in scheduling on a single processor...

MD06 Workforce Scheduling in Service Systems

Cluster: Service Design

Invited Session

Chair: John C. Goodale, Ball State University, Dept. of Mgmt., Coll. of Bus., Muncie, IN 47306, jgoodale@bsu.edu

1) Staffing a Finite, Multi-Server Queue with Two Customer Classes, Fred F. Easton, Syracuse University, Brethen Operations Mgmt. Inst., Sch. of Mgmt., Syracuse, NY 13244, ffeaston@syr.edu

Many call centers use finite multi-server queue models to determine staffing levels. We show that when service times fall into 2 distinct distributions, the M/M/C/N model understates the probabilities of high system occupancy, resulting in unexpectedly high workloads for call-takers and long queue times for callers.

2) Scheduling Agents with Multiple Skill Levels in an Inbound Call Center, Michael J. Brusco, Florida State University, IMS Dept., Coll. of Bus., Tallahassee, FL 32306, mbrusco@cob.fsu.edu, **Larry W. Jacobs**

To reduce labor costs, call-centers that deal with a variety of incoming call categories utilize agents who possess multiple skills, resulting in a highly complex combinatorial scheduling problem. We develop an ILP model to deal with this complexity and demonstrate its utility using data from an operating call-center.

3) Designing Services for Real-Time Labor Management, Gary M. Thompson, Cornell University, Sch. of Hotel Admin., Ithaca, NY 14853, gmt1@cornell.edu

Workforce scheduling has 4 component tasks: forecast customer demand, calculate the employee requirements, develop an actual schedule and control the schedule in real-time. We focus on the 4th task, the one ignored in the literature but the one that is crucially important in matching service capacity to service

demand.

MD07 Material Management

Contributed Session

Chair: Kevin R. Gue, Naval Postgraduate School, Dept. of Systems Mgmt., Monterey, CA 93943, krgue@nps.navy.mil, web.nps.navy.mil/~krgue

1) A Conjecture of the EOQ Problem in an Inventory Model, Yuan H. Wang, QED, 5602 Wood Thrush Ct., Fairfax, VA 22032, ywang01@aol.com, Jianwen Luo, C. C. Chang

We study the EOQ problem under the supplier credit of fixed payment and obtain a sufficient condition on the conjecture* which is incorrect under the same circumstances if $N > 2$. We also give examples to verify the result when $N=2$ and $N=3$. (Conjecture*: The total cost reaches minimum when the M equal size of orders exactly satisfy the demands over the N months under the supplier credit of fixed payment...)

2) Optimum Order Size: A Mathematical Programming Approach, John Moussourakis, Rider University, 2083 Lawrenceville Rd., Lawrenceville, NJ 08648, moussourakis@rider.edu, Donald Wise

In the inventory problem, the case where the per unit purchase is a function of the size of the order has been extensively investigated. We additionally consider the holding and/or ordering costs to be a function of the size of the order and suggest an optimizing model.

3) The Co-Printing Problem, Marc Peeters, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, 3000, Belgium, marc.peeters@econ.kuleuven.ac.be, Zeger Degraeve

The co-printing problem finds its origin in the printing of Tetra-bricks in the beverage industry. Combining different bricks in one printing pattern reduces the stock. This combination is subject to technical constraints. We propose a stock-minimizing multi-period algorithm for the problem and test it on real data.

4) Competition in Manufacturing, Pranab Majumder, University of Rochester, Simon Sch. of Bus., Rochester, NY 14627, majumderpr@simon.rochester.edu, Harry Groenevelt

We examine competition between an OEM and a local remanufacturer using various assumptions on the mechanics for collecting returns. A unique pure strategy Nash equilibrium exists for the single period problem and the stationary multi-period problem with myopic players is analyzed. Sensitivity results and policy implications are provided.

5) Optimizing Picking Waves in a Warehouse, Kevin R. Gue, Naval Postgraduate School, Dept. of Systems Mgmt., Monterey, CA 93943, krgue@nps.navy.mil, web.nps.navy.mil/~krgue

In a warehouse, orders are batched to allow for more efficient picking tours but larger batches tend to increase cycle times. We show how to choose the number and timing of picking waves in a warehouse to minimize order cycle time. We present results from a distribution center in California.

MD08 Stochastic Modeling & Computational Methods

Sponsor: Applied Probability Society

Sponsored Session

Chair: Qi-Ming He, Dalhousie University, Dept. of IE, Halifax, Nova Scotia, B3J 2X4, Canada, qi-ming.he@dal.ca

1) Entrywise Perturbation Theory for Diagonally Dominant M-Matrices with Applications to GI/M/1 Type Markov Chains, Attahiru S. Alfa, University of Manitoba, Dept. of MIE, Winnipeg, Manitoba, R3T 2N2, Canada, alfa@cc.umanitoba.ca, Jungong Xue, Qiang Ye

We establish some new entrywise perturbation results for diagonally dominant M-matrices. Applying this result to tail probabilities of a queue whose embedded Markov chains is of GI/M/1 type, we discuss the relative sensitivity of its percentile of the queue length.

2) Optimizing the GI/M/1 Queueing System with State-Dependent Arrival Rates, Winfried K. Grassmann, University of Saskatchewan, Dept. of Comp. Sci., 57 Campus Dr., Saskatoon, SK, S7N 5A9, Canada, grassman@cs.usask.ca, B. R. K. Kasyap, Xin Chen

We present a simple method for finding the departure rate and the expected number in the system in a GI/M/1 system in equilibrium. We also show that by solving the equilibrium equations, important information about the optimal service rate can be gained.

3) Production Switch in a Two-Stage Line with a Bottleneck, Hui Li, Mount St. Vincent University, Dept. of Math., 166 Bedford

Hwy, Halifax, Nova Scotia, B3M 2J6, Canada, hli@mvsu1.mvsu.ca, **Liming Liu**

We consider a (K, N) job release policy for a 2-stage production system where the second stage is the bottleneck while the first stage has a significant setup time. Using supplementary variables, we can construct a Markovian model and obtain analytical results for system performance. Based on the analytical results, we analyze the optimal release policy numerically.

4) Markov Additive Processes & Perron-Frobenius Eigenvalue Inequalities, Colm O'Connide, Purdue University, School of IE, West Lafayette, IN 47907-1287, colm@ecn.purdue.edu, Soren Asmussen

Asmussen & O'Connide showed that Markov modulation "elongates" the tail of the waiting time in M/G/1 queues. Here, we treat a family of related inequalities for Markov additive processes (O'Connide 1999). In particular, we prove a 1984 conjecture of J. E. Cohen and give a short proof of the Cohen-Friedland-Kato-Kelly inequality.

MD09 Supply Chain Models & Concepts

Cluster: Inventory Management

Invited Session

Chair: Paul Zipkin, Duke University, Fuqua Sch. of Bus., Durham, NC 27708-0120, paul.zipkin@duke.edu

1) The Logistics Industry in Transition: The Case of Hong Kong, Raymond K. Cheung, HKUST, Dept. of IE/EM, Clear Water Bay, Kowloon, Hong Kong, PR China, rcheung@ust.hk

With the hinterland of Southern China's manufacturing base, Hong Kong's re-export business has grown for 2 decades. High costs, fierce competition and supply chain management requirements, however, have reverted the trend. Hong Kong's logistics focus is changing from re-export to third-party logistics services. The corresponding challenges and initiatives are reviewed.

2) Game Theoretic Analysis of a Supply Chain with Multiple Suppliers & a Single Customer, Houmin Yan, Chinese University of Hong Kong, Dept. of SE/EM, Ho Sin Hang Engineering Bldg., Hong Kong, Shatin NT, PR China, yan@se.cuhk.edu.hk, Hanqin Zhang

We consider a supply chain model consisting of 2 suppliers and 1 customer, where suppliers compete for customer demand with the individual preference and the customer uses newsboy-type solutions as its inventory control policy. Since each supplier's bidding strategy affects the other's profit, game theory is used to find the optimal bidding strategies...

3) Supply Chain Coordination under Horizontal Competition, Siddharth Mahajan, Duke University, Fuqua Sch. of Bus., Durham, NC 27708-0120, mahajan@mail.duke.edu, Garrett J. van Ryzin

We analyze a 2-echelon supply chain (manufacturing trading with retailers) where there is horizontal competition among either manufacturers or retailers in one of the echelons. Customers dynamically substitute among goods at the retailer echelon based on availability. The performance of VMI and RMI mechanisms is compared to first-best. Results show that horizontal competition improves supply chain efficiency.

4) Salesforce Initiatives, Demand Forecasting & Production Planning, Fangruo Chen, Columbia University, Grad. Sch. of Bus., 3022 Broadway, Uris Hall 407, New York, NY 10027, fc26@columbia.edu

We study a model consisting of multiple sales agents serving different territories. The agents each have private information about the sales potentials for their own territories. The firm has 2 objectives: to induce its salesforce to provide accurate information on the sales potentials and to motivate them to work hard. We show how this problem can be solved.

MD10 Flexible Assembly

Cluster: Flexible Manufacturing Systems

Invited Session

Chair: Kathryn E. Stecke, University of Michigan, Sch. of Business Admin., 701 Tappan St., Rm. 5206, Ann Arbor, MI 48109-1234, kstecke@umich.edu

1) Automated Generation of Assembly System Configurations & Process Sequences, Robert F. Webbink, University of Michigan, Dept. of MEAM, 1210 Dow, 2300 Hayward St., Ann Arbor, MI 48109-2125, rwebbink@engin.umich.edu, S. Jack Hu, Kathryn E. Stecke

Assembly system configurations and process sequences have dramatic effects on various system performance indices. Large numbers of stations or assembly steps result in too many alternative solutions to efficiently analyze in a manual

manner. We present an automated method for generating these and selecting an optimal assembly system.

2) Mixed Integer Programming for Scheduling Flexible Flow Lines with Finite Capacity Buffers, Tadeusz J. Sawik, University of Mining & Metallurgy, Faculty of Mgmt., Al. Mickiewicza 30, Krakow, 30-059, Poland, tsawik@wzn4.zarz.agh.edu.pl

New MIP formulations are presented for scheduling a flexible flow line with blocking. The line consists of several processing stages in series, separated by finite intermediate buffers, where each stage has one or more identical parallel machines. A product which has completed processing on a machine may remain there and block the machine until a downstream machine becomes available for processing...

3) Dispatching, Conflict-Free Routing & Scheduling of Automated Guided Vehicles by Column Generation, Bryan Villeneuve, GERAD, Ecole Polytech., 3000 Cote-Sainte-Catherine, Montreal, Quebec, H3T 2A7, Canada, bryan@crt.umontreal.ca, Guy Desautniers, Andre Langevin

We consider the problem of dispatching, conflict-free routing and scheduling AGVs in an FMS in order to execute a set of transportation requests. This problem is modeled as a multicommodity network flow problem with additional constraints and is solved by column generation. Computational results will be presented.

MD11 Multivariate Statistical Quality Control: Methodology & Implementation

**Sponsor: Quality, Statistics & Reliability
Sponsored Session**

Chair: Daniel W. Apley, Texas A&M University, Dept. of IE, College Station, TX 77843-3131, apley@tamu.edu

Co-Chair: Jionghua Jin, University of Michigan, Dept. of IOE, 1927 IOE, Ann Arbor, MI 48109-2117, jhjin@engin.umich.edu

1) A Nonparametric Approach for Continuous Monitoring of Multivariate Processes using Wavelet Decomposition of Sensor Data, Eduardo Lerin, University of South Florida, Dept. of IMSE, Tampa, FL 33620, lerin@eng.usf.edu, Tapas K. Das

Many processes require monitoring via multiple correlated variables, which often don't satisfy the normality assumption necessary for most existing monitoring procedures. We put together a non-parametric multivariate quality monitoring technique using methods of principal components analysis, multi-resolution (wavelet) analysis and kernel density estimation. Efficiency of the technique is assessed for various types of data and process shifts.

2) A Multivariate Approach to Monitoring Univariate Autocorrelated Processes, Daniel W. Apley, Texas A&M University, Dept. of IE, College Station, TX 77843-3131, apley@tamu.edu

A new method of SPC of autocorrelated processes is presented. The method involves monitoring the T^2 statistic of a "multivariate" measurement vector constructed from time-delayed measurements of the original univariate autocorrelated process. Attractive characteristics include simultaneous monitoring of mean, variance and autocorrelation changes and robustness with respect to modeling errors and residual forecast recovery...

3) Quality Improvement through Dimensional Fault Diagnosis of Complaint Beam Structure Assemblies, Darek Ceglarek, University of Michigan, 1031 Dow Bldg., Dept. Mech. Eng. & App. Mech., Ann Arbor, MI 48109-2136, darek@engin.umich.edu, John Rong

A quality improvement methodology through dimensional root cause isolation of compliant parts during the assembly manufacturing process is proposed. The developed diagnostic procedure for single and multiple faults is based on parameter estimation and statistical decision theory. This methodology uses measurement data to isolate dimensional faults of compliant parts caused by part fabrication error and part-to-part interferences...

4) Multi-Fixture Assembly System Diagnosis using Part & Subassembly Variation Data, Johan S. Carlson, Chalmers University of Technology, Math. Statistics, S-412 96, Sweden, jsc@math.chalmers.se

A method for multi-fixture assembly system diagnosis is presented. The subassembly dimensional variation caused by the fixtures is identified using both part and subassembly measurement data. The variation is explained by either a multiple locator fault in a specified fixture or by a single locator error in an unspecified fixture.

MD12 Dynamic Programming & Transportation

**Cluster: Dynamic Programming
Invited Session**

Chair: Chelsea C. White, III, University of Michigan, Dept. of IOE, IOE Bldg., 1205 Beal Ave., Ann Arbor, MI 48109-2117, ccwiii@umich.edu

1) Value of a priori Package Destination Information in Delivery Vehicle Loading, David E. Benson, University of Michigan, Dept. of IOE, Ann Arbor, MI 48109-2117, Chelsea C. White, III

We model the problem of loading package express delivery vehicles where the objectives are to minimize loading, unloading and staging costs and to balance delivery vehicle loads. We examine the value of knowing a priori the destinations of certain types of packages or the destinations of packages delivered by specific linehaul trucks to the sorting facility.

2) Structural Dynamic Programming for Dynamic, Multicommodity Flow Problems in Transportation, Huseyin Topaloglu, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, Warren B. Powell

We consider the problem of managing heterogeneous fleets of vehicles to serve a set of tasks over a dynamic network. We illustrate a variety of dynamic programming approximations that provide near-optimal solutions to the classic problem. The methods work for both stochastic and deterministic networks.

3) Shortest Path Problems in Time-Dependent Networks: Algorithms with Optimal Run Times, Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu

We present algorithms with optimal run time that solve shortest path problems in time-dependent networks. These algorithms can be viewed as simple applications of the dynamic programming technique. We evaluate the computational performance of these algorithms using large-size networks. The developed algorithms show that the temporal dimension in dynamic networks presents not only challenges...

4) Empty Equipment Allocation & Vehicle Scheduling for Long-Haul Networks under Cyclic Constraints, Cenk Caliskan, University of Southern California, Dept. of ISE, 3715 McClintock Ave., Los Angeles, CA 90089-0193, caliskan@usc.edu, Randolph W. Hall

We develop models for equipment routing and crew scheduling in long-haul networks. Static LP optimizes flows of equipment and is solved by column generation. Dynamic IP optimizes the schedule of trailers and tractors and is solved by column generation and B&B. We suggest using both models for tactical and operational purposes.

MD13 Heuristics for Large-Scale Combinatorial Problems II

**Cluster: Search in Combinatorial & Nonlinear Optimization
Invited Session**

Chair: Gary A. Kochenberger, University of Mississippi, Ctr. for Enterprise Sci., Sch. of Bus. Admin., University, MS 38677, gkochenberger@bus.olemiss.edu

1) Surrogate Constraint-Based Heuristics for the Multiple Knapsack Problem, Guoqing Zhang, University of Mississippi, Ctr. for Enterprise Sci., Sch. of Bus. Admin., University, MS 38677, mszhang@cityu.edu.hk, Fred W. Glover, Gary A. Kochenberger

The multiple knapsack problem has been the object of considerable research in recent years. We investigate the application of new surrogate constraint constructs as the basis of constructive heuristics for solving such problem. Our approach is presented along with computational experience on new test problems ranging in size up to 2500 variables.

2) Scatter Search for Vehicle Routing Problems, Cesar Rego, University of Mississippi, Ctr. for Enterprise Sci., Sch. of Bus. Admin., University, MS 38677, crego@bus.olemiss.edu

Extensive studies of VRPs disclose that the best algorithms for obtaining near-optimal or optimal solutions consist of various alternative implementations of TS. We propose a new evolutionary algorithm based on scatter search and adaptive memory constructs (from TS). Novel conclusions drawn from experimental implementations are drawn.

3) Two-Dimensional Shelf Packing Problems, Andrea Lodi, University of Bologna, DEIS, Viale Risorgimento 2, Bologna, 40136, Italy, alodi@deis.unibo.it, Silvano Martello, Daniele Vigo

We consider the classic 2-dimensional bin and strip packing problems in which the rectangular items have to be packed from left to right in rows forming levels

(shelves). For these problems, we propose ILP models, together with combinatorial lower and upper bounds. The tightness of these bounds is tested through computational experiments.

4) Scatter Search to Generate Diverse MIP Solutions, David L. Woodruff, University of California, GSM, Davis, CA 95616, dlwoodruff@ucdavis.edu, Fred W. Glover, Arne Lokketangen

We concern ourselves with efforts to find a diverse set of solutions to MIP problems and provide methods of quantifying the notion of diversity. When the objective function is only an approximation of the actual goals of the organization, the one solution that optimizes it may be no more interesting than other solutions that provide good values.

MD14 Non-Convex Stochastic Programming

Cluster: Stochastic Programming

Sponsor: Optimization Section

Sponsored Session

Chair: Shabbir Ahmed, University of Illinois, Dept. of Chemical Eng. & MIE, 600 South Mathews Ave., Urbana, IL 61801, s-ahmed@uiuc.edu

1) Modeling Data Evolution in Integer Programs, Suvrajeet Sen, University of Arizona, Dept. of SIE, Tucson, AZ 85721, Julia L. Hagle

We will present integer programming applications in which a sequence of planning decisions and random variables generate data for an integer program. We will examine applications in product-mix planning, power generation and telecommunications.

2) A Stochastic Programming Application to Airline Crew Scheduling, Joyce Yen, University of Michigan, Dept. of IOE, Ann Arbor, MI 48109, John R. Birge

Stochastic programming is well-suited to industrial applications. With the airways becoming increasingly more congested and flight delays more common, random disruptions wreak havoc on crew schedules. We take a stochastic programming approach to this problem and present results from a sample test case.

3) Global Optimization of Two-Stage Stochastic Integer Programs, Shabbir Ahmed, University of Illinois, Dept. of Chemical Eng. & MIE, 600 South Mathews Ave., Urbana, IL 61801, s-ahmed@uiuc.edu, Mohit Tawarmalani, Nick Sahinidis

The highly non-convex nature of stochastic integer programs motivates the need for global optimization approaches. We develop a B&B-based global optimization algorithm for 2-stage stochastic integer programs with discretely distributed parameters. We devise specialized lower bounding and branching strategies and discuss finiteness issues.

4) Decomposition of Test Sets in Stochastic Integer Programming, Ruediger Schultz, Gerhard-Mercator University Duisburg, Dept. of Mathematics, Lotharstr. 65, Duisburg, D-47048, Germany, schultz@math.uni-duisburg.de, Raymond Hemmecke

We present a decomposition method for stochastic integer programs. The idea is to decompose not the problem itself but an object intimately related, namely its (Graver) test set. Test set computation essentially rests on algebraic arguments. Due to excessive problem dimension, direct computation of test sets for stochastic integer programs is prohibitive. Instead, we compute constituents of test set elements...

MD15 Robust Optimization

Cluster: Linear Programming/Complementarity

Sponsor: Optimization Section

Sponsored Session

Chair: Reha H. Tutuncu, Carnegie Mellon University, 6113 Wean Hall, Dept. of Math Sci., Pittsburgh, PA 15213, reha@andrew.cmu.edu

1) An Interior-Point Method for a Class of Saddle-Point Problems, Bjarni V. Halldorsson, Carnegie Mellon University, Wean Hall 6113, Dept. of Math. Sci., Pittsburgh, PA 15213, bjarni@andrew.cmu.edu, Reha H. Tutuncu

We present a polynomial time interior point algorithm for a class of nonlinear saddle-point problems. In particular, this can be applied to solve problems arising from the robust optimization formulation of quadratic programs. As an application, we give a robust formulation of the Markowitz portfolio selection model.

2) On the Robust Optimization Problems, Jian Yang, University of Texas, MSIS Dept., Austin, TX 78712, jiany@uts.utexas.edu, Gang Yu

The problem of finding the path whose worst-scenario total length is the shortest in a multi-scenario environment is studied. The problem is found to be NP-hard even when the underlying network is layered and there are only 2 scenarios. However, a pseudo-polynomial optimal algorithm for this problem is achieved.

3) A Stochastic Decomposition Method for Semiconductor Capacity Allocation, S. David Wu, Lehigh University, Dept. of IMSE, 200 W Packer Ave., Bethlehem, PA 18015-1582, david.wu@lehigh.edu, Suleyman Karabuk

We examine the semiconductor capacity allocation problem. Since the monolithic stochastic model with demand and capacity uncertainties is computationally intractable, we study models separable to demand planning and capacity management subproblems. We propose a recourse approximation approach where the submodels approximate each other's scenarios until an equilibrium condition is reached.

4) Robust Convex Programming, Arkadi Nemirovski, Technion Israel Institute of Technology, Davidson Sch. of Mgmt., Faculty of IE & Mgmt., Technion City, Haifa, 32000, Israel, nemirovs@ie.technion.ac.il, Aharon Ben-Tal

We discuss a methodology to produce "reliable" solutions of well-structured convex programs, i.e., linear, conic quadratic, semidefinite programming, etc., with uncertain data varying in a given uncertainty set, along with presenting related theoretical results and illustrative examples.

MD16 Operations Research in Rail Operations

Sponsor: Transportation Science Section/RASIG

Sponsored Session

Chair: Alexandra M. Newman, Naval Postgraduate School, OR Dept., Monterey, CA 93943, newman@nps.navy.mil

1) Multi-Attribute Decision Analysis of Train Dispatchers at Inter-Train Conflict Resolution, Ismail Sahin, Yildiz Technical University, Dept. of Civil Eng., Transportation Research Group, Besiktas, Istanbul, 80750, Turkey, ismail.sahin@yildiz.edu.tr

We model the inter-train conflict resolution process of train dispatchers as a multi-attribute choice problem and use 2 LP models in order to weight the attributes used. This approach could be used as a training tool for inexperienced dispatchers and as a comparison tool for evaluation of heuristic algorithms.

2) Adaptive Dynamic Programming for Locomotive Scheduling, Belgacem Bouzaiene-Ayari, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, Warren B. Powell

We propose an adaptive dynamic programming algorithm for managing a fleet of locomotives for a major railroad. The algorithm uses a linear value function approximation with a nonlinear stabilization term. The system allocates several thousand locomotives among 700 locations over a 10-day horizon, responding to incremental updates every minute.

3) An Integrated Model for Train Dispatching & Maintenance Scheduling, Yusin Lee, National Cheng Kung University, PO Box 7-206, Tainan, 701, Taiwan, yusin@mail.ncku.edu.tw, Li-Wen Chen, Chieh-Ju Chen

Trains have to be maintained at certain limited service mileage. We propose a MIP with embedded network flow structure that solves for an optimal train dispatch and maintenance schedule. The model size is linear to the number of trains in the system and can be easily modified to solve for various objectives.

4) Determining Processing Sequence of Trains in Railway Classification Yards, Edwin R. Kraft, 512 Partridge Way, Frederick, MD 21703, chipkraft@aol.com

This system was field tested in 1994 at Union Pacific's Hinkle yard. The goal was not to make all connections but to ensure that at least a subset of the most important ones were protected. A mixed integer, nonlinear mathematical programming problem was solved in 15-20 seconds on a small microcomputer.

MD17 Transportation Shipping

Contributed Session

Chair: Kang Tae Park, Pusan National University, Dept. of IE, Changejeon-dong, Kumsjeong-Ku, Pusan, 609-735, Korea, ktpark@hyowon.pusan.ac.kr, http://logistics.ie.pusan.ac.kr

1) Storage Assignment in Container Terminals, Chuqian Zhang, HKUST, Dept. of IEEM, Clear Water Bay, Kowloon, Hong Kong, iezeq@ust.hk, Jiyin Liu, Yat-Wah Wan

Assigning storage space to incoming containers is a critical issue in the management of container terminals. This is a multiobjective problem taking into account the container transportation distance, workload, etc. A 2-stage method is developed to solve the problem with MIP formulations in each stage. A

numerical example is presented.

2) Dispatching Cooperative Handling Equipment in Automated Port Container Terminals, Jong Wook Bae, Pusan National University, Dept. of IE, Changjeon-dong, Kumjeong-ku, Pusan, 609-735, Korea, jubae@logistics.ie.pusan.ac.kr, *Kap Hwan Kim*

A dispatching algorithm is developed for container handling equipment which performs container delivery operations cooperatively between an apron and a marshaling yard. A mathematical formulation and a heuristic algorithm are suggested. A simulation study is performed to evaluate the effect of the developed dispatching procedure.

3) A Simultaneous Scheduling Method for Berth & Container Cranes, Young-man Park, Pusan National University, Dept. of IE, Changjeon-dong, Kumjeong-ku, Pusan, 609-735, Korea, ymanpark@hyowon.pusan.ac.kr, *Kap Hwan Kim*

We aim at an efficient utilization of berth and container cranes which are the critical resources in port container terminals. An MIP model is formulated considering various constraints in practice. A heuristic algorithm is developed for deriving a near-optimal berth and cranes schedule using Lagrangean relaxation techniques.

4) A Simulation Study of Automated Container Terminals with Distributed, Autonomous & Cooperative Control Strategies, Kang Tae Park, Pusan National University, Dept. of IE, Changjeon-dong, Kumjeong-Ku, Pusan, 609-735, Korea, ktpark@hyowon.pusan.ac.kr, <http://logistics.ie.pusan.ac.kr>, *Seung Hwan Won, Kap Hwan Kim, Jae Kook Lim, Teruo Takahashi*

Various control issues aimed at applying to automated container terminals are discussed. A control architecture is proposed, based on distributed, autonomous and cooperative strategies. In order to validate the proposed control architecture, an object-oriented simulation software is developed. Various control algorithms are evaluated by a simulation study.

MD18 Using Multimedia & the Web to Enhance Student Learning in the Management Sciences

Sponsor: INFORM-ED

Sponsored Session

Chair: John A. Lawrence, California State University, Dept. of MS/IS, Fullerton, CA 92634, jlawrence@fullerton.edu

1) Using a Personal Website to Enhance Student Learning, John A. Lawrence, California State University, Dept. of MS/IS, Fullerton, CA 92634, jlawrence@fullerton.edu

More and more professors are utilizing websites in various ways to supplement or to completely deliver MS and statistics courses. Distance learning is also becoming prevalent. Some examples of effective uses of websites are presented.

2) The use of PowerPoint Narration to Enhance Student Learning of Statistics & Management Science, Barry A. Pasternack, California State University, Dept. of MS/IS, Fullerton, CA 92834, bpasternack@fullerton.edu

We discuss the use of animated and narrated PowerPoint slides together with WebCT as the basis of delivering graduate and undergraduate distance learning MS classes. Particular attention is paid to student motivation to enrolling in such a course, student learning outcomes and student satisfaction.

3) Using e-Stat to Enhance Student Learning of Statistics, Malcolm Getz, Vanderbilt University, Dept. of Economics, Box 1561B, Nashville, TN 37235, malcolm.getz@vanderbilt.edu

Here are 5 reasons for using a spreadsheet to teach statistics: show the ease of first use, critique charts by making them, do simulations, integrate numbers, charts and math without programming and it is a life skill. Use Excel as blackboard, text, calculator and problem solver.

4) Friendly Animation & Successful Teaching, Zvi Goldstein, California State University, Bus. Admin. & Economics, PO Box 6848, Fullerton, CA 92834, zgoldstein@fullerton.edu

Animation is used to create a positive atmosphere in the classroom and to enhance the participation of students in the learning process. Text, when properly animated, helps build more interest in the subject matter. Graphical animation is used to demonstrate mathematical concepts and to improve problem-solving skills.

5) Using a Website Creation Tool & an Online Learning Center to Enhance Student Learning, Julie Daniels, McGraw-Hill Higher Education, 26079 Wyndham, Sturgis, MI 49091, julie_daniels@mcgraw-hill.com

Putting your course online just easier with PageOut, a website creation tool by McGraw-Hill. Easy-to-follow templates help you create a homepage, instructor

page, Web links, syllabus and more. Moreover, you can even link to textbook-specific Online Learning Centers that include chapter overviews, activities and self-assessment quizzes.

MD19 OR/MS in Forestry I

Cluster: Forestry

Sponsor: ENRE

Sponsored Session

Chair: Tara M. Barrett, University of Montana, Sch. of Forestry, Missoula, MT 59812, tara@forestry.umt.edu

1) Modeling Interior Space with Dynamic Programming & Overlapping Subproblems, Howard Hoganson, University of Minnesota, 1861 Hwy 169 East, Grand Rapids, MN 55744, hogan001@tc.umn.edu, *Susan Bergmann*

A recently developed heuristic that combines dynamic programming with overlapping subproblems to address adjacency constraints has been expanded to model the production of interior space over time. Large test cases will be used to help describe the approach and its potential.

2) A Graph Model for Forest Openings, Evelyn Richards, University of New Brunswick, Fac. Forestry & Environ. Mgmt., North Forestry Bldg., Rm. 103, Fredericton, NB, E3B 6C2, Canada, ewr@unb.ca

Choosing the best spatial and temporal level of resolution is critical in designing optimization models for forest management. We describe a graph model to define and analyze forest openings. Extensions of the model to important spatial issues such as patch size, opening size and contiguity of habitat are discussed.

3) Incorporating Existing Wildlife Models in Forest Planning, Greg J. Arthaud, Yale University, Sch. of Forestry & Env. Studies, 360 Prospect St., New Haven, CT 06511, greg.arthaud@yale.edu

Most forest management planning models depend upon outside models to estimate future conditions. Typically, these models have not been developed specifically for use in a larger planning model. A moose population model is used to illustrate possible strategies for incorporating outside models into forest planning.

4) Forest to Product Production Planning in the Arrow Forest District of British Columbia, Thomas C. Maness, University of British Columbia, Faculty of Forestry, 2424 Main Mall, Vancouver, BC, V6T 1Z4, Canada, maness@interchg.ubc.ca, *Marian Marinescu*

A hierarchical planning method is described for log allocation over a forest to allocate logs to the manufacturing facility obtaining the highest value-added. The solution method uses an LP model decomposed into a subset of LP, dynamic programming and simulation models. The sub-models generate a "best set" of activities from which the master LP model can choose.

5) Adjacency Algorithms for Grouping Treatments, Tara M. Barrett, University of Montana, Sch. of Forestry, Missoula, MT 59812, tara@forestry.umt.edu

Silvicultural treatments such as thinning and prescribed burning are used to reduce fire hazard and to reach desired future conditions for vegetation structure. A variety of heuristic methods can be used to facilitate spatially grouping treatments. A small sample landscape is used to demonstrate alternative methods.

MD20 Theory & Applications of Evolutionary Algorithms III

Cluster: Evolutionary Algorithms

Invited Session

Chair: Jackie Rees, Purdue University, Krannert Sch. of Mgmt., West Lafayette, IN 47907, jrees@mgmt.purdue.edu

1) A Genetic Algorithm for Scheduling Operators in a Parallel Machine Environment, Bryan A. Norman, University of Pittsburgh, 1033 Benedum Hall, Dept. of IE, Pittsburgh, PA 15261, banorman@engr.pitt.edu

A GA is proposed to schedule operators in a parallel machine environment. Each operator is responsible for multiple machines but can only operate a subset of the machines simultaneously. The algorithm's effectiveness is demonstrated by comparing its performance with that of other methods on a set of test problems.

2) Evolutionary Algorithms for Location Problems, Joy Bhadury, California State University, Dept. of Mgmt. & Finance, Sch. of Business & Economics, Hayward, CA 94542, bhadury@csuhayward.edu

Of late, there has been an interest in applying evolutionary algorithms to solve

large-scale location problems, most of which are NP-hard. We will focus on the background, applications, results and the future of this new avenue of research.

3) Another Look at Learning Financial Trading Rules, Jackie Rees, Purdue University, Krannert Sch. of Mgmt., West Lafayette, IN 47907, jrees@mgmt.purdue.edu, Michael Cooper

Previous studies using evolutionary algorithms, in particular genetic programming, for learning trading rules from financial data have lead to unsatisfactory or inconclusive results. We examine the performance of learned trading rules via genetic programming using enhanced selection and crossover operations along with improved out-of-sample testing methodologies.

4) A Practical Application of the Genetic Algorithm in the Optimization of Gas Storage Facilities, Shadrack Orero, Hatch Associates Ltd., 800 Speakman Dr., Mississauga, Ontario, L5K 2R7, Canada, sorero@hatch.ca

Underground storage offers gas traders and users an efficient means of balancing their gas supplies with widely fluctuating seasonal, daily and hourly market requirements. Large financial benefits may be accrued from an economic allocation of the compressors for gas delivery operations. We demonstrate the practical application of GAs in the scheduling of gas storage facilities to maximize profits.

MD21 Tutorial: Experimental Design for Simulation Invited Session

Chair: W. David Kelton, University of Cincinnati, Dept. of QAOM, PO Box 210130, Cincinnati, OH 45221-0130, david.kelton@uc.edu, <http://www.econqa.cba.uc.edu/~keltond>

1) Tutorial: Experimental Design for Simulation, W. David Kelton, University of Cincinnati, Dept. of QAOM, PO Box 210130, Cincinnati, OH 45221-0130, david.kelton@uc.edu, <http://www.econqa.cba.uc.edu/~keltond>

This tutorial covers challenges, solutions and opportunities when experimenting with simulations. Careful design of simulation experiments is essential, saving time and effort by providing efficient ways to estimate effects of changes in the inputs on the outputs. Traditional experimental-design methods are discussed along with broader questions about planning computer-simulation experiments.

MD22 New Product & Technology Development

Cluster: Operations & Technology Strategy Invited Session

Chair: Janice Carrillo, Washington University, Olin Sch. of Bus., CB 1133, 1 Brookings Dr., St. Louis, MO 63130-4899, carrillo@wuolin.wustl.edu

1) Services under Pressure: An Empirical Study of Internet-Based New Service/Product Development & Delivery in Retail Banking, Larry Menor, University of Western Ontario, Ivey Sch. of Bus., 1151 Richmond St. North, London, Ontario, N6A 3K7, Canada, lmenor@ivey.uwo.ca, Aleda V. Roth

Given the emergence of Internet-based financial services startups, traditional retail banks are under pressure to focus on competencies to add innovative elements to their service package. Through retail banking survey data, we assess the impact of Internet-based technologies on the development of new services/products and on delivery channel strategies.

2) Examining the Tradeoff between Time-to-Market & Product Performance in Alternative Market Environments, Richard M. Franza, Bentley College, Dept. of Mgmt., 175 Forest St., Waltham, MA 02452-4705, rfranza@bentley.edu, Marilyn T. Lucas

As competitive pressures increase, firms attempt to enter new product markets more quickly. However, firms must tradeoff their time-to-market with product performance to determine how they can best compete. We present a model that examines this tradeoff and illustrates how the market that a firm competes in affects the tradeoff.

3) The Value of Manufacturing Flexibility in Pharmaceutical Development, Chester G. Chambers, Washington University, Olin Sch. of Bus., CB 1133, 1 Brookings Dr., St. Louis, MO 63130-4899, chambers@olin.wustl.edu

In the pharmaceutical industry, a "flexible" facility has the capability to produce virtually any product in the firm's portfolio. These facilities increase the firm's value because the availability of such capacity creates real options to defer expenditures for dedicated facilities until technical uncertainties are resolved. Stochastic DP is applied to evaluate the value of this flexibility...

4) The Impact of Industry Clockspeed on a Firm's New Product Development Activities, Janice Carrillo, Washington University,

Olin Sch. of Bus., CB 1133, 1 Brookings Dr., St. Louis, MO 63130-4899, carrillo@wuolin.wustl.edu

Empirical literature defines an industry's clockspeed as a measure of the dynamic nature of the industry. Among other things, the rate of new product development is found to be associated with an industry's clockspeed. Managerial insights are developed concerning the appropriate mechanisms driving a firm's NPD activities related to its industry's clockspeed.

MD23 Optimization in Electricity Generation

Cluster: Energy

Sponsor: ENRE

Sponsored Session

Chair: Geoffrey Pritchard, University of Auckland, Dept. of Stats., Private Bag 92019, Auckland, New Zealand, pritchar@scitec.auckland.ac.nz

1) Optimizing Generators Offers in an Electricity Market, Philip Neame, University of Auckland, Dept. of Engineering Sci., Private Bag 92019, Auckland, New Zealand, p.neame@auckland.ac.nz, Andrew Philpott, Geoffrey Pritchard

New Zealand has recently implemented an electricity spot market similar to many such markets being introduced around the world. We briefly outline the structure of this market, then consider a generator offering into the market. For a given time period, they must submit an offer stack consisting of a finite number of quantity-price pairs (or tranches)...

2) Negative Prices & Must-Run Generation Auctions in Electricity Markets, Geoffrey Pritchard, University of Auckland, Dept. of Stats., Private Bag 92019, Auckland, New Zealand, pritchar@scitec.auckland.ac.nz, Andrew Philpott, Philip Neame

We consider wholesale spot markets for electricity in which generation is offered in the form of closed bid supply curves that are then dispatched by a central authority to minimize the total revealed cost of delivered power. The dispatch optimization problem is assumed to be convex and approximated by an LP. Markets of this type operate in New Zealand, Australia, England and Wales and parts of North America...

3) Stochastic Dynamic Programming for Hydro Scheduling using AMPL, Tom S. Halliburton, Enron Corporation, 15135 Memorial Dr., Apt. 7104, Houston, TX 77079, tom.halliburton@enron.com, Jan Grygier

Pacific Gas & Electric have developed a stochastic dynamic programming model as a part of their hydro generation planning process. The AMPL modeling language and its looping features are used to repeatedly solve linear sub problems. A technique proposed by Stedinger et al is used to represent hydrological scenarios.

MD24 Aspen Technology's e-Supply Chain Suite

Invited Session

Chair: Brian T. Downs, Aspen Technology, Inc., 6715 Winterwood Lane, Dallas, TX 75248, brian.downs@aspentech.com

1) Aspen Technology's e-Supply Chain Suite, Brian T. Downs, Aspen Technology, Inc., 6715 Winterwood Ln, Dallas, TX 75248, brian.downs@aspentech.com, Jennifer Rich

This software demonstration will highlight the way in which OR technology has been integrated with the Internet and other technologies to create a suite of products that has made Aspen Technology the leading provider of supply chain solutions to the process industries and number one in customer satisfaction.

MD25 Information Systems II

Contributed Session

Chair: Warren G. Briggs, Suffolk University, 8 Ashburton Place, Boston, MA 02108, wbriggs@suffolk.edu

1) Information Infrastructure & Channel Management in E-Business, Shankar Sundaresan, Pennsylvania State University, 316 Beam Bldg., University Park, PA 16801, shankar-s@psu.edu, www.smeal.psu.edu/msis/profiles/sundaresan.html

With the advent of e-commerce, firms are employing different strategies for managing their channels. We present these strategies and discuss an information-oriented framework for analyzing the emergence of new channel management architectures.

2) The Impact of Information Technology on Supply Chain Management, Xin He, South Carolina State University, School of Bus., 300 College St. NE, Orangeburg, SC 29117, xhe@scsu.edu

We examine the impact of IT on supply chain management in terms of corporate

infrastructure and systems integration. We develop an analytical model to help determine the effect of using supply chain software on inventory lead-time. Real data examples are used to provide managerial insights.

3) Towards Automatic Chinese Temporal Information Extraction, Wenjie Li, Chinese University of Hong Kong, Dept. of SE&EM, Shatin NT, Hong Kong, China, wjli@se.cuhk.edu.hk

Temporal structures are important semantic carriers in languages. The target of the system presented is to automatically discover time-related activities and their temporal relationships from Hong Kong financial news reports. Our work also aims at providing a formal temporal knowledge representation for facilitating temporal reasoning.

4) Managing in the New Electronic Marketplace, Norman P. Archer, McMaster University, School of Bus., 1280 Main St. West, Hamilton, Ontario, L8S 4M4, Canada, archer@mcmaster.ca, **Judith Gebauer**

We describe in detail B2B electronic marketplaces, including sell-side, buy-side and intermediary-supported multi-vendor catalog systems that link customers and suppliers. We discuss the role of management in making economic choices among these forms, depending on their advantages and disadvantages for both suppliers and customers.

5) Outsourcing for Internet Services, Warren G. Briggs, Suffolk University, 8 Ashburton Place, Boston, MA 02108, wbriggs@suffolk.edu

This current field research describes several cases of firms outsourcing for aspects of Internet services. Field studies included Houghton Mifflin Co., EDS, BlueCross/BlueShield, Andersen Consulting Ventures, Cahners Publishing and Foxboro Company. It contrasts their experience with earlier studies of IT outsourcing and suggests strategic and tactical "best practices."

MD26 Data Access for Optimization

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Robert Fourer, Northwestern University, Dept. of IE/MS, 2225 North Campus Dr., Evanston, IL 60208-3119, 4er@iems.nwu.edu

Co-Chair: David M. Gay, Bell Labs, Lucent Technologies, 600 Mountain Ave., Murray Hill, NJ 07974-0636, dmg@research.bell-labs.com

1) Accessing Stock Market Historical Data over the Web, Tom Aird, Windward Technologies, Inc., PO Box 18101, Reno, NV 89511, tomaird@maxthis.com, www.MaxThis.com

We discuss accessing stock-market historical data over the Internet. The context is a program for portfolio management that uses the historical data for efficient frontier computations. Portfolios with a specified risk and return are determined by solving a quadratic programming problem.

2) Using Servlets to Support Real-Time Decision Making over a Wireless Network, Arnold H. Buss, Naval Postgraduate School, TRAC-Monterey, Box 8692, Monterey, CA 93943-0692, abuss@nps.navy.mil, **Maximo Moore**

A database operating over a wireless network was designed to support a rapidly unfolding military mission. The network evolves as wireless clients are added and removed. The database is updated during the mission to reflect current information. Clients access the database using JDBC with a Java servlet front end.

3) Relational Database Access for an Algebraic Modeling Language, Robert Fourer, Northwestern University, Dept. of IE/MS, 2225 North Campus Dr., Evanston, IL 60208-3119, 4er@iems.nwu.edu, **David M. Gay**

We describe new features of the AMPL modeling language that exploit parallels with relational databases to facilitate exchanging information between AMPL and database files. Modular "handlers" let vendors or developers add database connections without modifying the core AMPL code. Various I/O modes permit flexible conversions between AMPL and relational tables.

4) Database & Spreadsheet Access with OPL, Irvin J. Lustig, ILOG, 1080 Linda Vista Ave., Mountain View, CA 94043, ilustig@ilog.com

The Optimization Programming Language OPL has some novel features for importing and exporting data to and from multiple external databases from a variety of vendors. In addition, OPL has support for importing spreadsheet data. We will describe these features and contrast the issues of database vs. spreadsheet data representation in an algebraic modeling language.

MD27 Panel: Using Trading Rooms in Teaching & Research

Sponsor: Financial Services Section
Sponsored Session

Chair: Bruce W. Weber, CUNY, Baruch College, Zicklin Sch. of Bus., New York, NY, bruce_weber@baruch.cuny.edu

1) Panel: Using Trading Rooms in Teaching & Research, John Bilson, Illinois Institute of Technology, Stuart Sch. of Bus., Chicago, IL, bilson@stuart.iit.edu, **Mark Broadie,** Columbia University, Grad. Sch. of Business, 415 Uris Hall, 3022 Broadway, New York, NY 10027-6902, mnb2@columbia.edu, **Pete Chandler,** NASDAQ Stock Market, University Programs, Washington, DC, chandlep@nasd.com, **Jay Sultan,** Bentley College, Waltham, MA, jsultan@bentley.edu

Educational trading rooms are growing in number and popularity as a way of combining theory and financial services practice and giving students hands-on experience with advanced financial technologies. Developers of market trading labs at several institutions will describe their use of facilities to access and use real-time market data to teach sophisticated analytic tools...

MD28 Facilities Planning & Design

Contributed Session

Chair: Abdullah Dasci, McGill University, Fac. of Mgmt., 1001 Sherbrooke St. West, Montreal, Quebec, H3A 1G5, Canada, adasci@management.mcgill.ca

1) A Heuristic Method for Optimizing Highway Horizontal Alignment, Juey-Fu Cheng, National Cheng Kung University, Dept. of Civil Eng., 1 University Rd., Tainan, 701, Taiwan, cjf@civil.ncku.edu.tw, **Yusin Lee**

A model and a 2-stage heuristic are proposed to solve the horizontal alignment design of a highway project. Factors considered include land use restriction, transportation and traffic requirements. The model and algorithm are tested with an example. Testing results yield correct and good solutions and are solved efficiently.

2) Solving Minimax Location-Allocation Problems with Euclidean Distances by Simulated Annealing, Madjid Zia Saeedi, Iran University of Science & Technology, 11 Hasan Mollaei St., 3rd Fl., Vali-Asr Ave., Vali-Asr Sq., Tehran, Iran, z_saeedi@sun.iust.ac.ir, **Ali Eshragh Jahromi**

An SA algorithm was developed to solve the minimax location-allocation problems with Euclidean distances. Its performance was compared with another method which is used to solve these problems. The results show that SA is a good alternative to another method.

3) Continuous Approximation Models for Plant Location & Capacity Acquisition, Abdullah Dasci, McGill University, Fac. of Mgmt., 1001 Sherbrooke St. West, Montreal, Quebec, H3A 1G5, Canada, adasci@management.mcgill.ca, **Vedat Verter**

We will present a model for simultaneous optimization of facility location and capacity acquisition decisions where demand and the rest of the parameters are represented in continuous functions over the entire market. Our objective is to find the optimal number and location of facilities and their respective service regions.

MD29 Simulation in Industry

Sponsor: College on Simulation
Sponsored Session

Chair: John M. Charnes, University of Kansas, Sch. of Business, 222 Summerfield Hall, Lawrence, KS 66045-2003

1) Demands of Supply Chain Applications on Simulation Techniques, Deb Sadowski, Systems Modeling Corp., 504 Beaver St., Sewickley, PA 15143, dsadowski@sm.com, **Thomas Clausen**

The types of analyses performed in large-scale supply chain simulations place new demands on the design of simulation models, both from a technical and practical standpoint. We examine these demands and illustrate how they were met with cases from industrial practice.

2) Effective Strategies for Building Large-Scale Simulation Models in a Collaborative Environment, Russ Workman, Andersen Consulting, 11951 Freedom Dr., Reston, VA 20190, russell.w.workman@ac.com

Building large-scale simulation models requiring a team of modelers presents special challenges in both planning and implementation. I utilize industry experiences to detail these challenges and to describe effective means to

overcome them.

3) Simulation Applications in Service Industries, David Ferrin, Andersen Consulting, 3773 Willow Rd., Northbrook, IL 60062-6212

We will provide an overview of models constructed in separate service industries, specifically insurance and financial service corporations. The insurance work evaluated potential processes centered around direct billing capabilities. The financial services firm model evaluated electronic documentation capital hardware expenditures and associated systems and a model which evaluated push/pull work cell considerations for its service area.

MD30 Models of Work Group Performance

Sponsor: MSOM

Sponsored Session

Chair: Kenneth H. Doerr, University of Miami, Sch. of Bud. Admin., 414 Jenkins Bldg., Coral Gables, FL 33124-9145, kdoerr@exchange.sba.miami.edu

Co-Chair: David C. Juran, Columbia University, 319 Uris Hall, New York, NY 10027, dj114@columbia.edu

1) Cyclic Schedules for Paced Assembly Lines & Multiple-Skilled Workers, George L. Vairaktarakis, Case Western Reserve University, Weatherhead Sch. of Mgmt., 10900 Euclid Ave., Cleveland, OH 44106-7235, gxv5@guinness.som.cwru.edu, **Janice K. Winch, Xiaoqiang Cai**

In synchronous assembly lines, jobs visit all stations in the same sequence and spend the same amount of time by utilizing the appropriate number of workers. The set of stations is partitioned into skills. We consider the problem of developing cyclic schedules of jobs that minimize the workforce size.

2) Group Values, Emergent Interdependence & Group Effectiveness, Ruth Wageman, Dartmouth College, Tuck Sch. of Bus. Admin., Tuck Hall, Dartmouth, NH 03755, ruth.wageman@dartmouth.edu

Groups working under ambiguous conditions can self-structure based on the values of members. I found that groups with strong egalitarian values developed highly interdependent task strategies while groups with individualistic values used non-interdependent strategies. Both types performed well compared to those with no shared values but each type developed distinctive internal processes.

3) Task & Team Effects in the Design of Business Processes, Stephen G. Powell, Dartmouth College, Tuck Sch. of Bus. Admin., 100 Tuck Hall, Hanover, NH 03755, sgp@dartmouth.edu

We study the division of labor and the use of teams in the design of serial production processes with variable processing times for each task. Our results on the optimal size of teams and the optimal division of labor contradict the popular principle that the case worker design is best.

4) Within-Group Interdependence Effects in Operating Contexts, Kenneth H. Doerr, University of Miami, Sch. of Bud. Admin., 414 Jenkins Bldg., Coral Gables, FL 33124-9145, kdoerr@exchange.sba.miami.edu, **David C. Juran, Kenneth L. Schultz**

We examine the impact of within worker variability on the performance of a serial line production system. Empirical results are compared with theories from the fields of organizational behavior and MS.

MD31 Managing Uncertainty in Operations

Sponsor: MSOM

Sponsored Session

Chair: Ananth V. Iyer, Purdue University, Krannert Sch. of Mgmt., 1310 Krannert Bldg., West Lafayette, IN 47907, aiyer@mgmt.purdue.edu

1) Sharing to Gain: Supply Chain Coordination with Revenue Sharing, Gerard Cachon, Duke University, Fuqua Sch. of Business, Box 90120, Durham, NC 27708, gpc@mail.duke.edu, **Martin Lariviere**

With the traditional contract in the video rental industry, a retailer pays \$65 for each video tape and the retailer keeps all rental revenue. With a "revenue sharing" contract, a retailer pays \$8 per tape but then the studio earns a portion of the retailer's rental revenue. We study the nature of those contracts in a general model...

2) Self-Balancing Cyclic Logistics Systems, Don Eisenstein, University of Chicago, Grad. School of Bus., 1101 East 58th St.,

Chicago, IL 60637, don.eisenstein@gsb.uchicago.edu

A set of trains or buses that cycle through their routes, or a manufacturing facility that cycles through a production sequence are examples of cycle logistics systems. We derive a class of algorithms that will restore balance to such systems after a single shock or disruption occurs.

3) Heuristics for Appointment Scheduling, Lawrence W. Robinson, Cornell University, 511 Malott Hall, Johnson Grad. Sch. of Mgmt., Ithaca, NY 14853-4201, lwr2@cornell.edu, **Rachel Chen**

When service times are uncertain, the problem of setting customer appointment times must balance the waiting time for the customers against the waiting time (or overtime) of the service provider. Because a long service time of an initial customer will delay others throughout the day, this problem is fairly intractable...

4) Managing Capacity Faced with Order Streams with Differing Variability, Ananth V. Iyer, Purdue University, Krannert Sch. of Mgmt., 1310 Krannert Bldg., West Lafayette, IN 47907, aiyer@mgmt.purdue.edu, **Apurva Jain**

We discuss the interaction effect when ordering streams differing in demand variability share manufacturing capacity. We discuss the impact of sharing capacity, carrying finished goods inventory, priority scheduling and capacity splitting. We analyze the impact on retailer incentives to reduce demand variability.

MD32 Agent Technology I

Sponsor: Computing Society

Sponsored Session

Chair: Kaushal Chari, University of South Florida, ISDS Dept., 4202 East Fowler Ave. CIS 1040, Tampa, FL 33620-7800, kchari@coba.usf.edu

1) Building a Collaborative Unified Modeling Language Tool using an Agent-Based Toolkit, Venkat Ramesh, Indiana University, Kelley Sch. of Bus., 1309 East 10th St., Bloomington, IN 47405, venkat@indiana.edu

Recent years have seen an increased interest in the development of collaborative tools to support the systems analysis and design (SA&D) process. We describe the development of a collaborative UML tool using an agent-based toolkit that provides the generic infrastructure needed to develop collaborative SA&D applications.

2) An Agent-Based Approach to Internet-Based Transaction Support, Kaushal Chari, University of South Florida, ISDS Dept., 4202 East Fowler Ave. CIS 1040, Tampa, FL 33620-7800, kchari@coba.usf.edu, **Paul J. Hu**

The use of software agents to support or automate online transactions is an interesting research issue with enormous implications to real-world e-commerce practices. We propose and develop a distributed multi-agent-based transaction support/automation system that simulates online transaction and negotiation processes, then experimentally evaluates the system's performance and user acceptance.

3) Managing Online Information Privacy: A P3P Agent Testbed, Ramayya Krishnan, Carnegie Mellon University, Heinz Sch. of PP&M, 500 Forbes, Inst. for Complex Eng. Systems, Pittsburgh, PA 15213-3875, rk2x@cmu.edu, <http://krishnan.heinz.cmu.edu>, **Rema Padman, Uday Rajan, Danny Fernandes**

We discuss our work on managing online privacy on the Web using the P3P protocol. We present a game-theoretic formulation of the agent negotiation and preliminary results of computational experiments and a user study.

MD33 Advances in IBM's Optimization Solutions & Library II

Contributed Session

Chair: John Forrest, IBM Research, jforrest@us.ibm.com

1) The Evolution of Programming Interfaces in the IBM Optimization Library, Robert H. Clark, IBM, roclark@us.ibm.com

We will discuss the use of the current programming interface in OSL V2, with focus on how to set controls, load model information and solve models. This older interface will then be compared with the new C-API with examples that could be compiled and run by beta-test users.

2) Solving Stochastic Integer Programs with IBM's OLS Stochastic Extensions, Gyana Parija, IBM Research, parija@us.ibm.com

The C-API of IBM's OSL stochastic extensions presents a set of new functions to handle integer variables present in stochastic LPs. We describe how stochastic integer programs can be effectively solved by combining well-known

MIP preprocessing techniques such as branching rules, prioritization of sets, etc.

3) An Introduction to the Beta-Test Programming Interface for the Next Version of IBM's Optimization Library, Gyana Parija, IBM Research, parija@us.ibm.com

The C-API of IBM's Optimization Library will bring significant improvements to performance, function and management of model solving using the Optimization Library. We will review these enhancements, outline the current beta-test program and invite additional interested parties to participate.

MD34 Panel: Publishing Technology Management Research in IEEE Transactions on Engineering Management

**Sponsor: Technology Management Section
Sponsored Session**

Chair: Dunder F. Kocaoglu, Portland State University, Engineering Mgmt. Program, Portland, OR 97207-0751, kocaoglu@emp.pdx.edu

1) Panel: Publishing Technology Management Research in IEEE Transactions on Engineering Management, George F. Farris, Rutgers University, Organization Mgmt. Dept., 180 University Ave., Newark, NJ 07102-1897, R. Balachandra, Northeastern University, MS Dept., 314 Hayden Hall, Boston, MA 02115, Jeffrey K. Liker, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, Cheryl Gaimon, Georgia Institute of Technology, DuPre Sch. of Mgmt., Atlanta, GA 30332-0520, Ilze Zigurs, University of Colorado, College of Business Admin., CB 419, Boulder, CO 80309-0419, Burton V. Dean, San Jose State University, 1 Washington Square, San Jose, CA 95192-0070, bvdean@aol.com, Alok K. Chakrabarti, NJIT, Sch. of Mgmt., University Heights, Newark, NJ 07102-1982, Frederick Betz, University of Maryland, Grad. Sch. of Mgmt. & Tech., University Blvd. at Adelphi, College Park, MD 20742-7043

The editor-in-chief and department editors of IEEE Transactions on Engineering Management will discuss the journal's objectives, strategies and philosophy and answer questions from the audience.

**MD35 Software Demonstration V
Software Demo Session**

Chair: To be announced

1) LINDO Systems, Inc.: Modeling with LINDO, LINGO & What's Best, Mark Wiley, LINDO Systems, Inc., 1415 North Dayton St., Chicago, IL 60622, mwiley@lindo.com

LINDO Systems will be highlighting the recent speed enhancements to our LP solver and demonstrating our line of popular mathematical modeling packages including new releases of: LINDO - our powerful linear and integer programming engine, LINGO - our integrated modeling language with linear/nonlinear solvers and What'sBest! - our large scale linear/nonlinear spreadsheet solver.

2) Autosimulations, Inc., Tyler Phillips, AutoSimulations, Inc., 655 Medical Dr., Bountiful, UT 84010, tyler_phillips@autosim.com

AutoMod is one of the most powerful and flexible discrete-event simulation software packages available. AutoMod combines the ease of a simulator with the power of a simulation language and includes templates for material handling, manufacturing and continuous flow. AutoMod also supports CAD input via IGES, VRML and SDX formats. Come see why AutoMod is the simulation software of choice...

Tuesday 08:30-10:00

TA01 Behavioral Decision Analysis

**Sponsor: Decision Analysis Society
Sponsored Session**

Chair: George Wu, University of Chicago, Grad. School of Bus., 1101 East 58th St., Chicago, IL 60637, george.wu@gsbpop.uchicago.edu

1) Measuring Value Trade-Offs, Philippe Delquie, INSEAD, Blvd. de Constance, Fontainebleau, France

We will review how some lessons learned from behavioral decision research can be used to design better methods to measure trade-offs. We will also discuss in what sense these assessment methods are "better" for decision analysis.

2) The Surprising Non-Precriptiveness of Prescriptive Models & How to Exploit It, Ward Edwards, Wise Decisions, Inc., 11466

Laurelcrest Rd., Studio City, CA 91604

Behavioral decision research grew from differences between normative and descriptive evaluation models, inference (Bayes) and decision (Max SEU). The 3 normative models together imply decision making is decomposable into 19 subtasks necessary for decisions, with implications for developing decision competence tests and for designing prostheses for the decisionally impaired.

3) A Behavioral Decision Analysis Approach to Scenario Analysis, George Wu, University of Chicago, Grad. School of Bus., 1101 East 58th St., Chicago, IL 60637, george.wu@gsbpop.uchicago.edu

Scenario analysis is a widely-used approach for strategic decision making. We explore its psychological usefulness and consider some decision analytic ideas that maximize its value.

**TA02 Muticriteria Decision Making I
Contributed Session**

Chair: N. K. Kwak, St. Louis University, Dept. of Decision Sci., 3674 Lindell Blvd., St. Louis, MO 63108, kwakn@slu.edu

1) Analytic Hierarchy Process for Dispersed Data, Yer V. Hui, City University of Hong Kong, Dept. of MS, 83 Tat Chee Ave., Hong Kong, China, msyervan@cityu.edu.hk, Long-sheng Cheng, Lawrence C. Leung

We consider the least squares procedure in the AHP. Least squares approximation of the pairwise comparison matrix by a matrix of lower rank is applied to the case that data is presented in a dispersed form. Group decision and interval AHP are discussed.

2) Approximability of a Weakly Efficient Solution in Stochastic Multi-Objective Programming, Jianwen Luo, Hangzhou Institute of Electronic Engineering, Mgmt. Dept., Hangzhou, Zhejiang, China, Yuan H. Wang

We study the approximability of a weakly efficient solution in stochastic multi-objective programming and prove that any weakly efficient solution sequence of the corresponding problems will constantly approximate to one of the weakly efficient solutions of the original problem if the random vector sequence $\{X(k)\}$ converges to X . This provides the theoretical base for constructing approximate algorithms.

3) Antibiotics Selection using the PROMETHEE Multicriteria Method, Jim Ilunga, Clinique Ste-Elisabeth, Av. de Fre 206, Brussels, 1180, Belgium, bestsprl@hotmail.com, Bertrand M. Mareschal

We propose a multicriteria approach to assist the physician in selecting the most appropriate type of antibiotics. The relevant criteria are identified and data are analyzed using the Decision Lab software (PROMETHEE methods). Practical results and the potential of this approach are discussed.

4) Modeling Wildlife Flow Releases in the North Platte River, Duane D. Stroup, US Bureau of Reclamation, PO Box 25007, D-8520, Denver, CO 80225, dstroup@do.usbr.gov

The North Platte River generates power, irrigates crops and supplies recreation. However, environmental regulations require that water be provided for endangered species. Due to the complex nature of this system and competing interests, we present a simulation model that quantifies the effects of providing water for species needs.

5) Developing an Effective Health-Care Information System through Productivity Improvement Planning, N. K. Kwak, St. Louis University, Dept. of Decision Sci., 3674 Lindell Blvd., St. Louis, MO 63108, kwakn@slu.edu, Chang Won Lee

We address important issues in allocating scarce health care resources for developing an effective health information system. An integrated MCDM model is developed and applied to planning, implementing and evaluating the system, based on financial, operational, human and information resources data. The proposed model provides decision makers with insights for developing effective operational strategies.

TA03 Analysis Support in the Joint Staff & Combatant Commands

**Sponsor: Military Applications Society
Sponsored Session**

Chair: Gabriel Rouquie, Jr., Logicon Modeling Simulation & Analysis Ctr., 2100 Washington Blvd., Arlington, VA 22204, grouquie@logicon.com

1) The Joint Virtual Analysis Capability, Barry Justice, Logicon Modeling Simulation & Analysis Ctr., 2100 Washington Blvd.,

Arlington, VA 22204, bjustice@logicon.com

JVAC is a collaborative environment enabling analysts to support the Joint Staff and CINCs in near real-time. JVAC will increase the effectiveness of planning and mission operations by providing easier, faster access to more quality information, including remote resources, reducing cycle time and bringing people together for collaborative analysis.

2) **The Theater Engagement Planning Management Information System**, *Robert Kloecker*, Logicon USEUCOM JASP, HQUSEUCOM, Unit 30400, Box 719, APO AE, 09128, kloecker@eucom.mil, *John Cunningham*

The National Military Strategy of SHAPE, RESPOND and PREPARE NOW require theater engagement plans (TEPs) in support of defense strategies. TEPMIS will support the collection, organization, management, deconfliction and assessment of TEPs. TEPMIS will standardize the TEP process, support engagement planning, identify critical resources and validate resource requirements.

3) **National Military Strategy: Subject Matter Experts - Audience Discussions**, *Gabriel Rouquie, Jr.*, Logicon Modeling Simulation & Analysis Ctr., 2100 Washington Blvd., Arlington, VA 22204, grouquie@logicon.com, *Barry Justice, Robert Kloecker*

The MNS builds on the national security strategy premise that the US will remain globally engaged to shape the international environment and create conditions favorable to US interests and global security. Building superior engagement plans is crucial to the support of this strategy. A panel of subject matter experts will discuss the critical issues involved.

TA04 Panel: The Future of Decision Analysis & Support

Cluster: The Future of Decision Analysis & Support

Invited Session

Chair: Freerk A. Lootsma, Delft University of Technology, Faculty ITS/TWI, Mekelweg 4, Delft, 2628 CD, The Netherlands, f.a.lootsma@its.tudelft.nl

1) **Panel: The Future of Decision Analysis & Support**, *Harold P. Benson*, University of Florida, Dept. of DIS, Gainesville, FL 32611, benson@dale.cba.ufl.edu, *Andrzej Lewandowski*, McHugh Software International, 1000 Bridgeport Ave., Shelton, CT 06484, andrzej.lewandowski@mchugh.com, *Margaret M. Wiecek*, Clemson University, Dept. of Math Sci., Clemson, SC 29634, wmalgor@clemson.edu, *James S. Dyer*, University of Texas, Dept. of MSIS, CBA 5.202, Austin, TX 78712, j.dyer@mail.utexas.edu

We are concerned with the possible directions for research in decision analysis and support, against the background of problems arising from the integration of methodological research in applied projects. The fortunes of the DAS project at IIASA are a vehicle for discussion.

TA05 Scheduling IV

Cluster: Scheduling

Invited Session

Chair: Wieslaw Kubiak, Memorial University of Newfoundland, Fac. of Bus. Admin., St. John's, NFL, A1B 3X5, Canada, wkubiak@kean.ucs.mun.ca

1) **Links between Task Precedence Graphs Revisited**, *Jacek A. Blazewicz*, Politechnika Poznanska, Instytut Informatyki, ul. Piotrowo 3a, Poznan, 60-965, Poland, *D. Kobler*

Precedence constraints are a part of a definition of any scheduling problem. We investigate relations between 2 graph representations of these constraints: task-on-arc and task-on-node. It is proved that the latter is more powerful. On the other hand, careful analysis reveals new classes of task-on-node graphs for which corresponding problems of scheduling pre-emptable tasks are polynomially solvable.

2) **Scheduling with Team-Work Jobs**, *Xiaoqiang Cai*, Chinese University of Hong Kong, Dept. of SE/EM, Shatin NT, Hong Kong, xqcai@se.cuhk.edu.hk, *X. Zhou*

We consider a class of scheduling problems that involve team work jobs. Each team work job consists of several components and requires a team of processors to complete it, with each team member processing a particular component. Once a processor completes its work on a job, it will be available immediately to work on the next job, whether or not the other components of the last job have been completed...

3) **A Fully Polynomial Time Approximation Scheme for the Completion Time Variance Problem**, *Wieslaw Kubiak*, Memorial University of Newfoundland, Fac. of Bus. Admin., St. John's, NFL, A1B 3X5, Canada, wkubiak@kean.ucs.mun.ca

We present a FPTAS for minimizing the variance of completion times of jobs on a single machine. The scheme has been obtained using an approach to constructing FPTASs proposed recently by Kubiak & Koyalov for a large class of NP-hard optimization problems.

4) **SLK Due Date Assignment & Scheduling**, *Valery Gordon*, National Academy of Sciences of Belarus, Inst. of Eng. Cybernetics, Surganov str. 6, Minsk, 220012, Belarus, gordon@newman.bas-net.by, *Jean-Marie Proth, Chengbin Chu*

Single machine scheduling problems with due date assignments under the SLK rule are considered. In these problems, the objective is to find a value of common slack of due dates and a schedule to minimize a given criterion based on the due dates and completion times of jobs.

TA06 Service Design for Multiple Customer Segments/Groups

Cluster: Service Design

Invited Session

Chair: Madeleine E. Pullman, SMU, Dept. of IS/OM, Dallas, TX 75275, mpullman@mail.cox.smu.edu

1) **Designing Services for Needs Segments: A Comparison of Archetype Segmentation, Mixture Models & Traditional Segmentation Techniques**, *Jeffrey D. Brazell*, The Modellers Research Group, Salt Lake City, UT 2006, jeffb@themodellers.com, *Christopher G. Diener*

When designing optimal service packages, one is usually targeting market segments that react to different service combinations differently. We compare 2 relatively new segmentation methods, archetype segmentation and mixture models, to more traditional distance-based segmentation methods such as K-means. Practical differences are discussed.

2) **In Search of the 24/7 Service Solution**, *Peter Tarasewich*, University of Maine, Dept. of MIS, Orono, ME 04469, tarase@maine.edu, *Madeleine E. Pullman*

Optimal service levels can vary not only from hour to hour over a given day but day to day over a given week. We present a model and heuristic that use a seller's utility function to find profitable attribute levels over time. An example in the area of restaurant design is provided.

3) **Cultural Implications of Queue System Delays**, *Scott E. Sampson*, Brigham Young University, Marriott Sch. of Mgmt., 660 TNRB, Provo, UT 84602, scott_sampson@byu.edu, *Kristie K. Seawright*

Our controlled study involves videotaped queue scenarios for treatments involving various explanations for delay, exploring the effects of queue delays on the perceived duration of waiting. A design issue is to determine policies for handling queue delays. The study was repeated in English and Russian for an interesting cross-cultural comparison.

TA07 Service Industry

Contributed Session

Chair: Turgut Aykin, Bell Laboratories, MSE Dept., Eng. Research Ctr., PO Box 900, Princeton, NJ 08542, taykin@lucent.com

1) **A General Manpower Planning System at the Missouri State Highway Patrol**, *L. Douglas Smith*, University of Missouri, Dept. of Bus. Admin., 8001 Natural Bridge Rd., St. Louis, MO 63121, ldsmith@umsl.edu, *Robert M. Nauss, Robert J. Banis, Robert J. Beck*

We discuss a set of manpower planning models developed and implemented for departments of a state-wide agency with highly diverse service characteristics and degrees of centralization. Several mathematical programming models, statistical models and analytical models compose a generalized manpower planning system for the agency.

2) **Service Quality Improvement: A Learning Curve Analysis in the US Domestic Airline Industry, 1987 - 1998**, *Nikos Tsikriktsis*, Boston University, School of Mgmt., 595 Commonwealth Ave., Boston, MA 02215, tsiks@bu.edu, *Michael A. Lapre*

We address a need expressed in the literature on learning curve research: to study different outcome measures in service settings. Do airlines have different learning rates for customer satisfaction (customer complaints) and technical service quality (lost luggage)? What is the impact of knowledge transfer, strategy similarity and operational complexity?

3) **The Impact of the Euro on Tourism**, *Vesna Vrtiprah*, University of Split, Fac. Tourism & Foreign Trade, Lapadska obala 7, Dubrovnik, 20000, Croatia, vesna@ftvt.hr

Tourism is closely linked with economic activity in general, as such, its development will inevitably be marked by the introduction of the Euro. Therefore, we evaluate the effects of the Euro for the tourism industry in the European countries not participating in the system.

4) E-Commerce Inroads in Rural Areas, Gerald E. Evans, University of Montana, Sch. of Bus. Admin., Missoula, MT 59812, jerry.evans@business.umt.edu

A quota survey of predominantly rural western Montana was conducted to determine Internet buying patterns and attitudes. Demographic variables and other factors were examined relative to purchasing behaviors and attitudes. Books, music, computers and securities were the commonly purchased items. Security, delivery times and returns were among the leading concerns.

5) Call Center Operations Management: Forecasting & Optimal Shift/Tour Scheduling, Turgut Aykin, Bell Laboratories, MSE Dept., Eng. Research Ctr., PO Box 900, Princeton, NJ 08542, taykin@lucent.com

We review the state-of-the-art in call center operations management and present new approaches to demand planning (forecasting) and optimal shift and tour scheduling. The new demand planning approach incorporates the performance metrics (forecasting) with the call center scheduling process. The new optimal shift/tour scheduling process provides an effective means for minimizing costs... shift/tour scheduling process provides an effective means for minimizing costs...

TA08 Applications of Applied Probability to Telecommunications

Sponsor: Applied Probability Society
Sponsored Session

Chair: L. D. Servi, GTE Laboratories, 40 Sylvan Rd., Waltham, MA 02254-1128, lds0@gte.com

1) Equilibrium Distribution of Block-Structured Markov Chains: The GTH Algorithm Revisited, L. D. Servi, GTE Laboratories, 40 Sylvan Rd., Waltham, MA 02254-1128, lds0@gte.com, **Chang Liu**

Many wireless telephone applications require solving a Markov chain whose transition matrix has a block tridiagonal structure with each block, itself, tridiagonal. We present improvements to previous algorithms, generalize the analysis to higher dimensions and present and solve a potential associated singularity problem.

2) Yield Management for Telecom Networks: Modeling a FEDEX-Type Data-Courier Service, Salal Humair, MIT, OR Ctr., Bldg. E40-135, Cambridge, MA 02139, salal@mit.edu

Yield management for telecommunication networks can be operationalized using innovative services. For instance, consider a FEDEX-type service utilizing only spare capacity and guaranteeing delivery within pre-specified deadlines. We address admission control for one such service to maximize revenue while ensuring delivery within deadlines. Optimal policies for simple models are presented.

3) Ordering Access Protocols for Wireless Reserve Channels, Daryl J. Daley, Australian National University, Sch. of Math Sci., CMA, Canberra ACT, 2601, Australia, daryl@maths.anu.edu.au, **L. D. Servi**

A wireless cellsite with reserve channels can provide preferential treatment for hand-in traffic over newly originating traffic. We compare several protocols for using these channels: irrespective of the service and arrival rates, the protocols can be ordered by the blocking probabilities for hand-in traffic for a given total blocking rate.

TA09 Supply Chain Integration & Management

Contributed Session
Chair: Susan X. Li, Adelphi University, School of Mgmt. & Bus., 1 South Ave., Box 701, Garden City, NY 11530, li@panther.adelphi.edu

1) Optimal Risk Sharing & Value Allocation in a Supply Chain, Steve Peng, York University, Schulich Sch. of Bus., 4700 Keele St., North York, Ontario, M3J 1P3, Canada, hpeng@interlog.com, **John A. Buzacott**

Increasingly, firms are concentrating on their core competencies. As a result, joint programs among supply chain partners are invaluable to pool critical skills and facilities when opportunities emerge. We present a stochastic model to help coordinate the commitments and rewards among parties when significant uncertainties as well as opportunities exist.

2) Cooperation between Enterprises & Networked Organization in China, Xinyu Dong, Xi'an Jiaotong University, Dr. 715, Xi'an,

Shaanxi, 710049, China, xinyudong@263.net, **Huaizu Li**

The relation between several networked organizational structures and cooperative styles between enterprises is studied. The present condition of networked organization and the several main factors which influence the forming and development of network organization in China are analyzed and we give some suggestions.

3) A Game Model in Inventory Supply Chain Systems, Susan X. Li, Adelphi University, School of Mgmt. & Bus., 1 South Ave., Box 701, Garden City, NY 11530, li@panther.adelphi.edu, **Zhimin Huang**

We explore the impact of quantity discounts on a simple buyer-seller supply chain system where the buyer is in a monopolistic position. The efficiency of transactions is discussed utilizing interactive game theory. An example is provided to illustrate our theoretical findings.

4) withdrawn - author request of 2/24, Margaret K. Schaefer, College of William & Mary, Dept. of Math, Williamsburg, VA 23187-8795, mkscha@math.wm.edu

TA10 Planning II

Contributed Session
Chair: Amitava Dutta, George Mason University, 4400 University Dr., Fairfax, VA 22030, adutta@gmu.edu

1) A Nonlinear Programming Solution to Planning Car Production Distribution, Tomas Hrycej, DaimlerChrysler AG, Wilhelm-Runge-Str. 11, Ulm, D-89013, Germany, tomas.hrycej@daimlerchrysler.com

If the focus of planning the global distribution of car production from multiple plants to the markets is on homogeneity and fairness of distribution rather than on profit maximizing alone, the task becomes a nonlinear constrained programming task. A working solution (problem size: 100000 variables and 200000 constraints) is presented.

2) Optimizing Design & Planning Problems Subject to Complex Tax, Royalty & Tariff Rules, Susara Van den Heever, Carnegie Mellon University, Dept. of Chemical Eng., 5000 Forbes Ave., Doherty Hall, Pittsburgh, PA 15213, susara@andrew.cmu.edu, http://www.econ.cheme.cmu.edu/susara, **Ignacio E. Grossmann**

We address the issue of incorporating complex tax, royalty and tariff rules into optimization models for long-term design and planning. We present alternative formulations, including big-M and disjunctive models. These are applied to a design and planning problem for offshore oilfield infrastructures, which is solved with a specialized decomposition/aggregation algorithm.

3) Cellular Network Design: Site Selection & Frequency Planning, Amitava Dutta, George Mason University, 4400 University Dr., Fairfax, VA 22030, adutta@gmu.edu, **Vernon N. Hsu**

We present a cost minimization planning model for cellular networks. The model simultaneously determines 2 crucial variables - base station site selection and channel group assignments for spatial frequency reuse - that affect system cost. It also captures important technical details such as antenna types and schemes to reduce adjacent channel interference.

TA11 Recent Work in Experimental Design I

Sponsor: Quality, Statistics & Reliability
Sponsored Session

Chair: Kurt Palmer, University of Southern California, Dept. of ISE, Los Angeles, CA 90089-0193, kpalmer@usc.edu

1) Applications of Low Cost Response Surface Methods in Manufacturing Process Optimization, Liyang Yu, Ohio State University, Dept. of ISE, 1971 Neil Ave., Columbus, OH 43210, yu.149@osu.edu, **Theodore T. Allen**

LCRSMs have been proposed as attractive alternatives to standard methods with 30% fewer runs than small composite designs. We discuss the robustness of LCRSM, drawing on theoretical results based on the expected integrated means squared error criterion and multiple LCRSM case studies.

2) Stochastic Optimization for Robust Machine & Tolerance Design, Theodore T. Allen, Ohio State University, Dept. of ISE, 1971 Neil Ave., Columbus, OH 43210-1271, allen.515@osu.edu, **James Brady**

Stochastic optimization, i.e., optimization where the objective is evaluated using numerical integration, permits more direct expressions of the societal loss than either SN ratios or the dual response approach permitting significant savings. We present applications including die casting and welding machine design and

tolerance design of PCBs.

3) Optimal Assembled Designs with Variance Components, Ana I. Aviles, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, **Bruce A. Ankenman, Jose F. Pinheiro**

An assembled design is a hybrid design which places a nested design at each design point in a crossed design. This allows for the estimation of both main and interaction effects as well as variance components that arise from nested random factors such as lot number and batch number. Optimal assembled designs are constructed and discussed for many practical situations.

4) Assembled Designs for Dispersion Effects, Bruce A. Ankenman, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, **ankenman@iems.nwu.edu, Ana I. Aviles, Jose F. Pinheiro**

Assembled designs, a hybrid experimental design which places a nested design at each design point in a crossed design, are discussed for the estimation of dispersion effects on variance components. The existence of dispersion effects allows for the reduction of variance components such as lot-to-lot variance and batch-to-batch variance through manipulation of process or design variables.

TA12 Scheduling, Delivery & Location

Cluster: Networks

Sponsor: Optimization Section

Sponsored Session

Chair: Janny M.Y. Leung, Chinese University of Hong Kong, Dept. of SE/EM, Shatin NT, Hong Kong, msjanny@cityu.edu.hk

1) Crew Scheduling for Airport Baggage Services, Christina Yuen, University of Hong Kong, Dept. of Mathematics, Hong Kong, Hong Kong, christinayuen@yahoo.com, **Sydney C. K. Chu**

We report the work on a crew scheduling/rostering problem for the baggage services section of the Hong Kong Airport Services, Ltd. at the Hong Kong International Airport. An optimization modeling approach is adopted, with the problem formulated by integer linear goal programming. Main contributions include verifiably feasible and more efficient crew schedules/rosters.

2) Formulation & Solutions for Pickup & Delivery of Indistinguishable Items, Moshe Dror, University of Arizona, Coll. of Bus. & Public Admin., Dept. of MIS, Tucson, AZ 85721, mdror@mail.bpa.arizona.edu, **Dominique Fortin, Catherine Roucairol**

We examine the problem of efficient redistribution of indistinguishable items on a given graph of pickup and delivery nodes. The solution requires generating distribution paths which are not necessarily simple. We present a graph transformation approach and construct exact solutions based on problem decomposition. We also test heuristic solution methodologies for this problem...

3) Graph-Coloring-Based Models for Districting with Service-Time Constraints, Ada S. F. Ng, Chinese University of Hong Kong, Dept. of SE/EM, Hong Kong, Shatin NT, Hong Kong, sfng@se.cuhk.edu.hk, **Janny M.Y. Leung, Xiaoqiang Cai**

Some service providers have to provide on-site service in a reasonably short time, e.g., vehicle breakdown emergency service. Often, the area of coverage is zoned into a certain number of districts, each serviced by a mobile unit. The objective is to minimize the number of mobile units needed while meeting service-time requirements...

4) Competing Shipping on Networks, Jeanine Smallwood, University of Arizona, Dept. of SIE, PO Box 210020, Tucson, AZ 85721-0020, **Pitu B. Mirchandani**

We will review the combined problems of locating container ports, shipping carrier network design (route capacities and frequencies) and shippers decisions on routing and carrier choices. Then, we will focus on the equilibrium problems associated with multiple competing shippers and 2 competing carriers.

TA13 Telecommunications & Heuristic Search

Cluster: Search in Combinatorial & Nonlinear Optimization

Invited Session

Chair: Erik Rolland, University of California, AGSM, Riverside, CA 92521, erik.rolland@ucr.edu

1) Efficient Solution Procedures for Reliable Network Design, Samit Soni, Vanderbilt University, Owen Grad. Sch. of Mgmt., Nashville, TN 37203, samit.soni@owen.vanderbilt.edu, **Hasan Pirkul**

We present an efficient solution procedure for reliable network design based on constraint addition procedures. Problems investigated include 2- and 3-path

node disjoint network design. Computational results are presented.

2) The Cardinality Constrained Covering Traveling Salesman Problem, Raymond A. Patterson, University of Texas at Dallas, School of Mgmt., Richardson, TX 75083-0688, **Erik Rolland**

We propose a new method for partitioning a graph into an unspecified number of Hamiltonian subgraphs with minimum and maximum size requirements on the subgraphs. We refer to this as the CCC-TSP. Special cases include the assignment problem and the TSP. The solution methodology presented guarantees feasible solutions to be within 1% of the globally optimal solution...

TA14 Methods & Algorithms for Stochastic Programming

Cluster: Stochastic Programming

Sponsor: Optimization Section

Sponsored Session

Chair: K. A. Ariyawansa, Washington State University, Dept. of Pure & Applied Math., Pullman, WA 99164-3113

1) Interior Cutting Plane Algorithms for Stochastic Programming, A. Felt, Washington State University, Dept. of Pure & Applied Math., Pullman, WA 99164-3113, **K. A. Ariyawansa**

Recently, Ariyawansa & Jiang presented a family of interior point cutting plane algorithms for stochastic programming. These are interior point analogs of the Van Slyke & Wets algorithm but have complexity linear in the number of realizations. We present parallel computational results for certain members of this family of algorithms.

2) Operator Splitting Methods for Multistage Stochastic Programming, Lisa Korf, University of Washington, Dept. of Math., Seattle, WA 98195

Dual problems and optimality conditions emphasizing decomposability are established for a general class of stochastic dynamic optimization problems. Based on these results, operator splitting methods, which have been successfully employed on parallel machines for deterministic problems of this form, are generalized to cover the stochastic case.

3) Optimization of Conditional Value-at-Risk, Stanislav Uryasev, University of Florida, Dept. of ISE, PO Box 116595, 303 Weil Hall, Gainesville, FL 32611-6595, **R. T. Rockafellar**

A new approach for optimization or hedging of a portfolio of finance instruments to reduce the risks of high losses is suggested and tested with several applications. As a measure of risk, the expected loss exceeding value-at-risk is used, called conditional VaR, mean excess loss, mean shortfall or tail VaR. This approach allows to optimize portfolios with large numbers of instruments and scenarios.

4) Barrier Decomposition Methods with Inexact Solutions of Subproblems for Stochastic Programming, G. Zhao, National University of Singapore, Dept. of Math., 10 Kent Ridge Crescent, Singapore, 119260

Recently, I proposed a new method for solving stochastic programming problems. The method is based on the decomposition principle and adopts the idea of self-concordant barrier to generate a smooth and strictly convex objective function of a master problem. Newton's method is used to solve the master problem. The computation of Newton's directions utilizes solutions of subproblems...

TA15 Nonlinear Complementarity Problems

Cluster: Linear Programming/Complementarity

Sponsor: Optimization Section

Sponsored Session

Chair: Florian Potra, UMBC, Dept. of Math & Stats., 1000 Hilltop Circle, Baltimore, MD 21250, potra@math.umbc.edu

1) Algorithms for Degenerate Nonlinear Programming, Mihai Anitescu, University of Pittsburgh, Thackeray 301, Pittsburgh, PA 15260, anitescu@math.pitt.edu

We present approaches for obtaining a local solution of NLPs with linearly dependent gradients of the active constraints. We also discuss the relevance of this work to mathematical programming with equilibrium constraints.

2) Globalization Strategies for Inexact Interior Point Methods for Mixed Complementarity Problems, Stefania Bellavia, Universita di Firenze, Dept. di Energetica "S Stecco", Via C. Lombroso 6/17, Firenze, 50134, Italy, stefania@risemat.de.unifi.it, **Benedetta Morini**

We present a globally convergent inexact-interior-point method based on the GMRES iterative solver. A backtracking technique along a piecewise linear curve is used. Such a strategy is restricted to a proper low-dimensional subspace

and based on the information built on the progress of the linear iterations.

3) A Trust Region Method for Nonlinear Complementarity Problems, Andreas Fischer, University of Dortmund, Dept. of Mathematics, Dortmund, 44221, Germany, andreas.fischer@math.uni-dortmund.de

The NCP is reformulated as a minimization problem with non-negativity constraints. The latter problem is treated by a trust region method with particularly scaled and exactly solvable subproblems. The iterates generated by this method stay in the non-negative orthant. Beside global convergence properties, an active constraint identification technique provides local superlinear convergence.

4) Numerical Validation of Solutions of Nonlinear Complementarity Problems, Goetz E. Alefeld, University of Karlsruhe, Inst. Angewandte Mathematik, Kaiserstrasse 12, Karlsruhe, D-76128, Germany, goetz.alefeld@math.uni-karlsruhe.de, **XiaoJun Chen, Florian Potra**

A validation method for solutions of NCP is proposed, based on a computable interval operator associated with the reformulation of the NCP as a nondifferentiable system of nonlinear equations. Using this interval operator, the existence of solutions of the NCP can be verified numerically.

TA16 Dynamic Routing & Scheduling

Sponsor: Transportation Science Section
Sponsored Session

Chair: Warren B. Powell, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, powell@princeton.edu

1) An Integer Programming Formulation of the Probabilistic TSP in which All Nodes have Equal Probability of Coverage, Xiubin Wang, University of California, Inst. of Transport Studies, Irvine, CA 92697, xwang@uci.edu, **Amelia C. Regan**

We present an integer programming formulation for the probabilistic TSP in which each node has equal probability of requiring a visit. The formulation leads to some interesting results by itself and also leads to a new formulation for the TSP which accommodates separation requirements explicitly.

2) Dynamic Programming Approximations for the Dynamic Assignment Problem, Michael Spivey, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, **Warren B. Powell**

A common problem in stochastic routing and scheduling is assigning resources to tasks over time, where both resources and tasks have (soft) time windows on their availability. We use a version of the dynamic assignment problem to test value function approximations for this problem class and demonstrate near optimal results for deterministic instances.

3) Models & Algorithms for Multi-Layered Resource Scheduling Problems, Hugo P. Simao, Princeton University, Dept. of OR & Financial Eng., Princeton, NJ 08544, hugo@dragon.princeton.edu, **Warren B. Powell**

We consider the problem of simultaneously managing drivers, tractors, trailers, product and customer inventories. We present the problem as a multi-layered resource scheduling problem. We formulate the problem as a dynamic resource transformation problem and propose an algorithm that integrates concepts from column generation, the auction algorithm and adaptive dynamic programming.

TA17 Making Network Equilibrium Models More Realistic

Sponsor: Transportation Science Section
Sponsored Session

Chair: David E. Boyce, University of Illinois, Dept. Civil & Materials Eng., 3073 ERF, 842 West Taylor St., Chicago, IL 60607, dboyce@uic.edu

1) Equilibration & "Feedback" in Complex Transportation Planning Models, Michael A. Florian, University of Montreal, CRT, CP 6128, Succ. Centre-Ville, Montreal, Quebec, H3C 3J7, Canada, mike@crt.umontreal.ca, **Jia Hao Wu, S. G. He**

Equilibration techniques are used to obtain consistent demand and service levels for complex transportation planning models. When the model is formulated as a variational inequality, the solution method may be an averaging scheme sometimes referred to as "feedback." This method is illustrated with a model for Santiago, Chile.

2) Primal Optimality Conditions for Route Flow Entropy Maximization, Hillel Bar-Gera, University of Illinois, Dept. Civil & Materials Eng., 842 West Taylor St., MC 246, Chicago, IL 60607-7023, hbargel@uic.edu

Given total (user equilibrium) link flow assignment, the entropy maximizing

route flow pattern has been proposed as the most likely, typically found by dual methods. We develop primal optimality conditions that provide additional insights. Possible application for algorithms will be discussed.

3) Validation Issues for Combined Travel Forecasting Models, David E. Boyce, University of Illinois, Dept. Civil & Materials Eng., 3073 ERF, 842 West Taylor St., Chicago, IL 60607, dboyce@uic.edu, **Hillel Bar-Gera**

Issues pertaining to the validation of a detailed regional travel forecasting model are described. The model forecasts consistent origin-destination, mode and auto route choices for multiple user classes for the Chicago region. Issues concern how to use census and household survey data to validate the model.

4) A Mesoscopic Approach to the Network Loading Problem, Michael A. Florian, University of Montreal, CRT, CP 6128, Succ. Centre-Ville, Montreal, Quebec, H3C 3J7, Canada, mike@crt.umontreal.ca, **Michael Mahut, Nicolas Tremblay**

Algorithms for dynamic traffic assignment require the solution of the network loading problem. This problem has been approached by analytical methods and by mesosimulation. We present a new event-based mesoscopic simulation model based on queueing theory and flow-density relationships originating from traffic flow theory. Numerical results are presented.

TA18 Student/Technology Issues in Web-Based Instruction

Sponsor: INFORM-ED
Sponsored Session

Chair: Siva R. Sankaran, California State University, Dept. of Acct. & MIS, 18111 Nordhoff St., Northridge, CA 91330-8372, siva@pacbell.net

1) Web Instruction: Filling the Gap between Theory & Practice, Ralph Ruby, Jr., Arkansas State University, Dept. Mgmt./Mktg./Bus. Systems, Coll. of Bus., State University, AR 72467, rruby@cherokee.astate.edu, **Paula D. Ladd**

Today's Web-Based courses vary in time continuum. Mostly, these courses have insufficient activities for students to build their skills. The lack of resources to write/test practice activities and keep them current is a challenge. Further, many textbooks rely on specific browsers. We present workable solution strategies to address these concerns.

2) Enhancing Web-Based Instruction using Streaming Audio with Powerpoint & ReadMedia, David Cary, California State University, Dept. of Finance, 18111 Nordhoff St., Northridge, CA 91330-8372, dcary@csun.edu

We show the dynamics of how a Powerpoint class presentation can be embedded with streaming audio and stored in a Web media server so that students can listen in virtual space and time. Data shows that student learning performance and satisfaction improved. ESL and disabled students were the greatest beneficiaries.

3) The Effect of Student's Locus of Control on Learning Performance: A Comparative Study in Web vs. Lecture Instruction, Siva R. Sankaran, California State University, Dept. of Acct. & MIS, 18111 Nordhoff St., Northridge, CA 91330-8372, siva@pacbell.net, **Tung X. Bui**

Using an internal-external continuum, LOC was measured for students taking courses in Web/lecture format. Results include: students with external LOC preferred lecture, age and internal LOC showed affinity for the Web, LOC was negatively correlated to performance irrespective of course format. Implications to Web-course design are discussed.

TA19 OR/MS in Forestry II

Cluster: Forestry
Sponsor: ENRE
Sponsored Session

Chair: Brian Kent, USDA Forest Service, Rocky Mt. Research Station, 240 West Prospect St., Fort Collins, CO 80524, bkent/rmrs@fs.fed.us

1) Incorporating Disturbance Frequency & Patterns in Assessing & Planning Management for Landscapes, J. G. Jones, USDA Forest Service, Rocky Mt. Research Station, PO Box 8089, Missoula, MT 59807, gjones/rmrs_missoula@fs.fed.us, **J. D. Chew**

Stochastic simulation predicts the frequency and location of insect, disease and fire disturbance processes associated with no action. Results are incorporated with other issues into a DSS for developing spatially-specific treatment scenarios. These scenarios are then simulated to compare the frequency and location of disturbance with no action.

2) A Timing-Oriented Approach to Spatial Allocation of Fire

Management Effort, John Hof, USDA Forest Service, Rocky Mt. Research Station, 3825 East Mulberry, Fort Collins, CO 80524, jhof/rmrs@fs.fed.us

We explore optimization of the timing and location of fire management effort. The land area is divided into cells and the ignition times of protected cells are delayed as much as possible. Model variables track the entry and exit times of the fire front through all cells and account for each one's earliest ignition source.

3) Spatially Improving Harvest Schedules in Strategic Forest Planning Models, Michael Bevers, USDA Forest Service, Rocky Mt. Research Station, 240 West Prospect Rd., Ft. Collins, CO 80526, mbevers/rmrs@fs.fed.us

Strategic forest planning models tend to over-estimate efficient levels of timber harvesting. One reason for this problem is that spatial considerations such as clustering harvests for operational efficiency have typically been neglected in these long-term, large-scale models. We explore methods to address these deficiencies.

4) Maximal Species Survivability as a Function of Timber Harvest Volume, Derek J. Nalle, Oregon State University, Dept. of Stats., Kidder Hall 44, Corvallis, OR 97331-4606, nalle@stat.orst.edu, **Jeffrey L. Arthur, David Caulkin**

For any pre-specified level of extraction, timber harvest schedules maximizing the probability of species survival are developed. Description of the nontraditional GAI and preliminary results on a 1.7 million acre national forest are presented as well as marginal cost curves between volume and survivability.

5) A Comparison of Management Strategies for Control of Depredation by Wolves in Minnesota, Robert G. Haight, USDA Forest Service, North Central Res. Station, 1992 Folwell Ave., St. Paul, MN 55108, rhaight/nc@fs.fed.us, **Laurel E. Travis**

To balance conflicting public demands for wolf protection and control, state agencies needed information on the potential impacts of wolf management strategies. We used a simulation model of wolf dynamics and a discrete stochastic comparison method to estimate strategies that minimized wolves killed and livestock depredation.

TA20 Performance Analysis of Queuing Models

Cluster: Math Modeling/Stat Inference/Comp Methods in Queuing System Invited Session

Chair: Sudha Jain, University of Toronto, Dept. of Stats., 100 Saint George St., Toronto, Ontario, M5S 3G3, Canada, jainsu@utstat.utoronto.ca

1) On the Finite-Buffer Bulk-Service Queue with General Independent Arrivals, U. C. Gupta, Indian Institute of Technology, Dept. of Math, Kharagpur, 731302, India, umesh@maths.iitkgp.ernet.in, **P. Vijaya Laxmi**

We consider a single server finite-buffer bulk-service queue in which the interarrival and service times are arbitrarily and exponentially distributed, respectively. The service is performed in batches of maximum size b . The distributions of number of customers in the queue at pre-arrival and arbitrary epochs have been obtained.

2) Control of Finite Capacity Queues with BMAP Arrivals & Phase-Type Group Services, Srinivas R. Chakravarthy, Kettering University, Dept. of IME & Business, 1700 West 3rd Ave., Flint, MI 48504-4898, schakrav@kettering.edu, **Dario Bin, Beatrice Moini**

A finite capacity queue with BMAP arrivals and phase type services (in groups of varying sizes) is studied. The service rate is increased depending on the queue length. The idle time, normal and fast periods are shown to be of phase type. An iterative algorithm based on regular splitting for computing system performance measures and some numerical examples are discussed.

3) The Generalized Double-Ended Queuing Models with Finite Waiting Space, Sudha Jain, University of Toronto, Dept. of Stats., 100 Saint George St., Toronto, Ontario, M5S 3G3, Canada, jainsu@utstat.utoronto.ca, **T S S Srinivasa Rao**

The modeling and analysis of a continuous-time generalized double-ended queuing system has been carried out using the supplementary variable method. A simple recursive algorithm has been developed for computing the distributions of the queue length of the number of customers at an arbitrary moment and at the moment of an arrival.

TA21 Simulation II

Contributed Session

Chair: Octavio Richetta, University of Massachusetts, MSIS Dept., 100 Morrissey Blvd., Boston, MA 02125-3393, octavio.richetta@umb.edu

1) A Causality Error Prevention Scheme in the Hybrid Simulation, Dong-Wook Seo, Korea University, 1, Anam-dong, Sungbuk-ku, Seoul, 136-701, Korea, seodw@kucn.korea.ac.kr, **Yong-Hyuk Kang, SungSchick Kim**

A hybrid simulation model consists of real (physical and logical) entities as well as simulated ones. In the hybrid simulation, the traditional central clock approach is used. However, there are still chances of causality errors due to the communication delays. We explain the error and propose a prevention scheme.

2) Strategic Simulations: Doing the Right Thing, William R. Bacon, Risk Management Systems Inc., 2000 Powers Ferry Rd., Ste. 300, Marietta, GA 30067, wrbacon@msn.com, http://www.RiskSystems.net

Strategic simulation is contrasted with traditional tactical simulations. Strategic simulation features are explained, contrasted and demonstrated to characterize strategic decision support simulation. Comparative performance issues cover throughput, logistics and resource utilization optimization problems under varying environmental conditions, simulation maturity and client requirements. Supporting cognitive learning simulation models are demonstrated.

3) A Stopping Procedure Based on Phi-Mixing Conditions, E. Jack Chen, University of Cincinnati, PO Box 210130, Cincinnati, OH 45221-0130, chenj@econqa.cba.uc.edu, http://www.econqa.cba.uc.edu/~chenj, **W. David Kelton**

We discuss the implementation of a sequential procedure to determine the batch size for constructing confidence intervals for the steady-state mean. Our quasi-independent procedure increases the batch size progressively until a certain number of i.i.d. samples are obtained. Our experimental results show that our sequential procedure gives valid confidence intervals.

4) Improving Simulation Efficiency with Quasi-Control Variates, Burton Simon, University of Colorado, Dept. of Math., Box 173364, Denver, CO 80217, bsimon@math.cudenver.edu, **Markus Emsermann**

QCVs are control variates with unknown means that are estimated in an auxiliary simulation. We find the optimal QVC procedure (in terms of asymptotic efficiency) and present a dynamic procedure that is almost surely optimal. Applications include stochastic programming, stochastic PDEs and queuing theory.

5) Porting a C++ (Windows) Simulation Framework into Java, Octavio Richetta, University of Massachusetts, MSIS Dept., 100 Morrissey Blvd., Boston, MA 02125-3393, octavio.richetta@umb.edu

We describe the process of porting a platform-dependent (Windows) discrete event simulation originally developed in C++ into Java. Emphasis will be placed on description of the Java classes. The advantages of platform independence are discussed and an example using a Web browser as the GUI presented.

TA22 Enterprise Information Technology Impact on Operational Performance

Cluster: Operations & Technology Strategy Invited Session

Chair: Andrew McAfee, Harvard Business School, Morgan T95, Soldiers Field, Boston, MA 02163, amcafee@hbs.edu

1) "Learning the Slopes": Understanding the Impact of Enterprise Resource Planning Implementation on Operational Process Performance, Mark Cotteleer, Harvard Business School, Soldiers Field, Boston, MA 02163, mcotteleer@hbs.edu

The impact of IT on business process performance remains a subject of intense debate. This research combines an account of managerial perceptions of the impact of ERP on operational performance with an empirical study of the actual operating performance of 24 sites following ERP implementation.

2) Technology & Weak Appropriation Conditions: The Adoption of Enterprise Resource Planning Systems, John E. Ettlie, Rochester Institute of Technology, Rochester, NY 14623, jeebbu@rit.edu

Firms simultaneously face strong (e.g., patents) and weak (e.g., R&D alliances) technology appropriability regimes. A representative sample of 60 ERP adopting firms drawn from the Fortune 1000 were used to test a model of weak appropriation with significant results.

3) IT Application Adoption & Operating Characteristics: Results from Two Countries, Arik Ragowsky, Wayne State

University, Detroit, MI 48202, aa7507@wayne.edu

To obtain the greatest benefit from its information systems, an organization must determine which applications will provide the most benefit. We review data collected from 310 firms in Israel and 197 in the US. For at least some applications, the benefits derived are significantly related to the organization's operating characteristics.

4) Mechanisms for IT Impact on Operational Effectiveness, Andrew McAfee, Harvard Business School, Morgan T95, Soldiers Field, Boston, MA 02163, amcafee@hbs.edu

Organization design theories that highlight information processing requirements suggest 3 mechanisms by which IT can impact operational effectiveness. Construct validity for these 3 mechanisms - commonality, functionality and visibility - is assessed using several criteria applied to a cross-sectional study of ERP adopters.

TA23 Optimization within the Energy Sector

Cluster: Energy

Sponsor: ENRE

Sponsored Session

Chair: Samer Takriti, Enron Corporation, 1400 Smith St., PO Box 218, Houston, TX 77002-7361, samer_takriti@enron.net

1) Energy & Environmental Profile of the US Mining Industry, Kenneth W. Boras, BCS Incorporated, 5550 Sterrett Pl., Ste. 306, Columbia, MD 21044, boras@clark.net, **Roy G. Tiley**

We identify state-of-the-art extraction and processing technologies and methods as well as provide baseline energy and environmental data for the industry. Commodities included in the profile are coal, potash, soda ash and borate minerals, iron ores, copper ores, lead and zinc ores, gold and silver ores, phosphate rock and limestone and other crushed rock...

2) Optimal Bidding Strategies in Multi-Period Competitive Electricity Markets

We consider a power market in which spot prices are determined by a central agency or a power pool. Given the minimum up-time and down-time constraints, a generating company submits bids so that its expected future profit is maximized. The pool selects bids so that its total cost of supplying power is minimized...

3) A Stochastic Programming Model for Day-Ahead Trading at a Power Exchange, Ruediger Schultz, Gerhard-Mercator University Duisburg, Dept. of Mathematics, Lotharstr. 65, Duisburg, D-47048, Germany, schultz@math.uni-duisburg.de, **Markus Westphalen**

The worldwide restructuring of the electricity industry entails new forms of dealing electric power. One of these is day-ahead trading at a power exchange. We develop a 2-stage stochastic programming model for the simultaneous optimization of electricity production and day-ahead trading. The solution methodology rests on scenario decomposition for stochastic integer programs...

TA24 IFORS Distinguished Lecture: or.edu & technology.com

Invited Session

Chair: Robert A. Abrams, University of Illinois, Dept. of Info. & Dec. Sci., 601 South Morgan, Chicago, IL 60607-7124, abrams@uic.edu

1) IFORS Distinguished Lecture: or.edu & technology.com, Thomas L. Magnanti, MIT, 77 Massachusetts Ave., Rm. E40-147, Cambridge, MA 02139-4307

New information and communication technologies are having a profound effect on university education and research, creating unprecedented opportunities for educational innovation and fundamentally new research possibilities. Education opportunities include the global classroom, increased collaboration across traditional university, university-industry and national boundaries, greater use of simulations and learning by doing and the use of ITs to create remote laboratories...

TA25 Business-to-Business E-Commerce: A Survey

Cluster: Business-to-Business E-Commerce

Invited Session

Chair: Michael J. Shaw, University of Illinois, Dept. of Business Admin., 350 Commerce West, Champaign, IL 61820, m-shaw2@uiuc.edu

1) Business Models in the Business-to-Business Arena: Strategies & Implications, Praveen A. Pathak, Purdue University, Dept. of MIS, Krannert Sch. of Mgmt., West Lafayette, IN 47907,

pathakp@mgmt.purdue.edu

We look at the various B2B models that are being explored by companies. We critically look at the strategic advantages that accrue in the B2B environment, both to the companies facilitating the transactions and also to the companies that benefit from them.

2) Analyzing Alternative Market Structures in Business-to-Business Electronic Commerce, Alina M. Chircu, University of Minnesota, Dept. of Info. & Dec. Sci., Carlson Sch. of Mgmt., Minneapolis, MN 55455, achircu@csom.umn.edu, **Robert J. Kauffman**

We analyze the effects of e-commerce on market structure (direct, intermediate, hybrid) in B2B settings by considering the effect of technological innovations on transaction delays and cost. Contrary to existing assumptions, the solutions of our analytical model suggest that under certain conditions, hybrid, not direct, markets are optimal from a welfare-maximizing perspective.

3) Determining the Optimal Growth Rate for E-Commerce Firms, Willard I. Zangwill, University of Chicago, Grad. Sch. of Bus., 1101 East 58th St., Chicago, IL 60637, willard.zangwill@gsb.uchicago.edu, **Deb Sarkar**

We present a mathematical optimization model of e-commerce firms, with Amazon as a prime example. The model yields the optimal growth rate and is robust and stable against uncertainty and time shift. Interestingly, it yields an

4) Information Systems Research Issues in Business-to-Business Electronic Commerce, Michael J. Shaw, University of Illinois, Dept. of Business Admin., 350 Commerce West, Champaign, IL 61820, m-shaw2@uiuc.edu

B2B e-commerce is an emerging research area with issues that need cross-disciplinary perspectives. It embodies prior research in inter-organization IS and covers topics ranging from Web-based procurement and supply chain management to market making and the role of intermediaries. We survey the related IS issues.

TA26 Reverse Logistics & Cash Flow

Sponsor: Section on Logistics

Sponsored Session

Chair: Ronald S. Tibben-Lembke, University of Nevada, Managerial Sci. Dept., MS 028, Reno, NV 89557, rtl@unr.edu

1) Issues on Returnable Logistical Packaging, Diana Twede, Michigan State University, Sch. of Packaging, East Lansing, MI 48824, twede@msu.edu

Returnable shipping containers can represent a significant savings in both purchase and disposal costs but they also have a significant effect on logistics costs because of the need to control the return cycle. We describe current trends in returnable packaging, including supply chain relationships, financial evaluation and package performance.

2) Cash-to-Cash Cycle Management, Wally Weart

No abstract supplied.

3) Reverse Logistics & the Product Lifecycle, Ronald S. Tibben-Lembke, University of Nevada, Managerial Sci. Dept., MS 028, Reno, NV 89557, rtl@unr.edu

The product lifecycle concept has been around for many years, applied mainly to marketing. We investigate the role that the product lifecycle has on companies' reverse logistics strategies, including results from our survey on more than 300 manufacturers and distributors.

TA27 Financial Engineering

Sponsor: Financial Services Section

Sponsored Session

Chair: Steve Kou, Columbia University, Dept. of IE/OR, Mudd Bldg., New York, NY 10027, kou@ieor.columbia.edu

1) Option Methods for Optimal Flexible Capacity Investment, John R. Birge, Northwestern University, McCormick Sch. of Engineering, 2145 Sheridan Rd., Evanston, IL 60208-3100, jrbirge@nwu.edu

Production capacity with flexibility to produce different types of products can be difficult to evaluate correctly with traditional methods. We consider the use of option pricing methods and describe their use in a dynamic investment policy when capacity can be reconfigured over time.

2) Exotic Option & Volatility Smiles, Vadim Linetsky, University of Michigan, IOE Dept., 1205 Beal Ave., Ann Arbor, MI

48109

It is a well-known empirical fact that implied volatility of equity index options are largely convex and monotonically decreasing functions of strike (the so-called volatility smile effect). We will examine the effect of volatility smiles on the valuation and hedging of barrier and look-back options. Cox's constant elasticity of variance diffusion process is used as a simple model for assets exhibiting volatility smiles...

3) Some Jump Diffusion Models in Financial Engineering, Steve Kou, Columbia University, Dept. of IE/OR, Mudd Bldg., New York, NY 10027, kou@ieor.columbia.edu

Jump diffusion models have been widely used in queueing theory. We will survey some of the recent papers by the author and co-authors on how to apply jump diffusion models to model interest rate, electricity options and real options.

TA28 Topics in Computational Mixed Integer Programming

Cluster: Computational Mixed Integer Programming
Invited Session

Chair: Ann Bixby

, abixby@us.ibm.com

1) Multiple Knapsack with Color & its Variations, Jayant Kalagnanam, IBM, TJ Watson Research Ctr., PO Box 218, Rte. 134, Yorktown Heights, NY 10598, jayant@us.ibm.com, **Ann Bixby, Milind Dawande, L. Ladanyi**

2) Integer Programming & Metacomputing, Jeffrey T. Linderot, Argonne National Laboratory, MCS Division, 9700 South Cass St., Argonne, IL 60439, linderot@mcs.anl.gov, **Qun Chen, Michael C. Ferris**

3) A Column Generation Approach to Product Clustering & Machine Setup in Printed Circuit Board Assembly, Amy Cohn, MIT, OR Ctr., E-40-130, 77 Massachusetts Ave., Cambridge, MA 02139, amycohn@mit.edu, **Michael Magazine, George G. Polak**

Numerous types of PCBs can be assembled from components dispensed from the sleeves of a pick and place machine. Column generation affords a way to solve large instances of an IP model that determines optimal clustering of PCB types and machines setups for a given production run.

4) Solving Multi-Item Capacitated Lot-Sizing Problems with Setup Times by Branch & Cut, Andrew J. Miller, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Ave., Atlanta, GA 30332-0205, andrew@udaloy.isye.gatech.edu, **Martin Savelsbergh, George L. Nemhauser**

TA29 Managing Product Variety I

Cluster: Managing Product Variety
Invited Session

Chair: Jayashankar Swaminathan, University of California, Haas Sch. of Bus., Berkeley, CA 94720, mjs@haas.berkeley.edu

1) Simultaneous Production of Universal & Market-Specific Products for Global Demand, Kyle D. Cattani, University of North Carolina, Kenan-Flagler Bus. Sch., Chapel Hill, NC 27599-3490, kyle_cattani@unc.edu, **Geraldo Ferrer, Wendell G. Gilland**

We model the use of a universal design in a 2-stage problem with markets that can be served with either market-specific products or for an additional cost per product, a universal product. We develop conditions for optimality in the single-replenishment cycle version that allow simultaneous production of universal and market-specific products...

2) Incentive Mechanisms & Supply Chain Design for Quick Response, Diwakar Gupta, University of Minnesota, Dept. of Mech. Eng., 111 Church St. SE, Minneapolis, MN 55455, guptad@me.umn.edu, **Saifallah Benjaafar, Am Weerawat**

Faced with random demand and lead-time sensitive unit-revenues, assemblers often require their suppliers to carry parts inventory. We analyze a different scheme in which coordination is achieved via the passage of a fraction of revenue earned from assembler to supplier. Both centralized and decentralized versions of the problem are studied.

3) Postponement Boundary for Global Supply Chain Efficiency, Hau L. Lee, Stanford University, Dept. of IE/EM, Terman 351, Stanford, CA 94305-4024, haulee@leland.stanford.edu, **Lingxiu Dong**

For products that require the integration of multiple subassemblies into multiple end-products, defining what is to be assembled in the factory and what is to be assembled in distribution is termed the postponement boundary problem. We describe a model that captures the cost tradeoffs in determining the right postponement boundary and illustrate the application of the model for a product design problem of workstations at the Hewlett-Packard Company.

4) Lot-Sizing under Postponement & Downward Substitution for a Perishable Product, Jayashankar Swaminathan, University of California, Haas Sch. of Bus., Berkeley, CA 94720, mjs@haas.berkeley.edu, **Simge Kukuyavuz**

We study a lot-sizing problem from the bio-technology industry with 3 interesting characteristics related to inventory management: perishability, postponement and substitution. We consider a reagent for detecting DNA sequences. We find the optimal lot-size under constant and varying deterministic demands and evaluate the benefits of investing in technology to mitigate the constraints on perishability and conversion.

TA30 Technology Acquisition & Capacity Expansion

Sponsor: MSOM

Sponsored Session

Chair: Candace A. Yano, University of California, IE/OR Dept., 4135 Etcheverry Hall, Berkeley, CA 94720-1777, yano@ieor.berkeley.edu

1) Technology Acquisition in a Stochastic Environment, Shanling Li, McGill University, Faculty of Mgmt., 1001 Sherbrooke St. West, Montreal, Quebec, H3A 1G5, Canada, li@management.mcgill.ca, **Atiqur Raman, Richard J. Loulou**

We study a technology acquisition problem in high-tech sectors where the progress of process technology and the demand for new products are quite uncertain. We develop a stochastic dynamic programming model and use heuristics together with algorithms to solve the model. Interesting managerial insights will be presented and discussed.

2) Coordinating Capacity Expansion & Inventory Management Decisions, Sampath Rajagopalan, University of Southern California, Marshall Sch. of Bus., BRI 400D, Los Angeles, CA 90089-1421, srajagopalan@sba.usc.edu, **Jayashankar Swaminathan**

We explore the interaction between production planning and capacity acquisition decisions in environments with demand growth. We develop a solution approach to determine optimal capacity acquisition, usage and inventory levels over time. We also investigate the impact of product variety, cost of capital and other important parameters on the decisions.

3) Technology Adoption, Capacity Planning & Equipment Flexibility in Multi-Product Manufacturing Systems, Pablo Durango, University of California, IE/OR Dept., Berkeley, CA 94720-1777, **Candace A. Yano**

Investments in new technology are often made because of additional flexibility afforded by this technology. We present a model for technology and equipment adoption when there are complex interactions between the nature and degree of equipment flexibility and the capacity required to meet customer demands in a timely fashion.

TA31 Operations & Supply Chain Scheduling

Sponsor: MSOM

Sponsored Session

Chair: Joseph B. Mazzola, Georgetown University, McDonough Sch. of Bus., 37th & O St. NW, Washington, DC 20057, mazzolaj@msb.edu

1) Supply Chain Scheduling: Batching & Delivery, Nicholas G. Hall, Ohio State University, Dept. of MS, 2100 Neil Ave., Columbus, OH 43210-1144, hall.33@osu.edu, **Chris Potts**

We consider scheduling, batching and delivery problems in supply chain manufacturing. Several objectives are considered from the viewpoint of the supplier and manufacturer. We show that collaboration between the supplier and manufacturer may reduce total cost significantly. Incentives for collaboration and extensions to larger supply chains are discussed.

2) Heuristics for the Launch Vehicle Manifest Problem, Richard L. Daniels, Georgia Institute of Technology, DuPree Coll. of Mgmt., 755 Ferst Dr., Atlanta, GA 30332-0520, rich.daniels@mgt.gatech.edu, **Leslie Olin Morgan, Alysse R. Morton**

The manifest problem involves the joint determination of the cost-minimizing mix of launch vehicles to produce and the optimal assignment of payloads of varying size to launch vehicles of different capacity. We exploit the bin-packing and cutting-stock structure of the problem to develop heuristics for several versions of the problem.

3) **Analysis of Algorithms for Two-Stage Flowshops with Multiprocessor Task Flexibility**, *George L. Vairaktarakis*, Case Western Reserve University, Weatherhead Sch. of Mgmt., 10900 Euclid Ave., Cleveland, OH 44106-7235, gxv5@guinness.som.cwru.edu, *Chung-Yee Lee*

In this 2-machine flowshop, 2 modes are available for each task for minimizing makespan: processing by the designated processor or simultaneously by both processors. Applications include labor intensive lines where products can be processed by pulling together work-teams of adjacent stations. We present algorithms supported by error-bound analyses.

TA32 Agent Technology II

Sponsor: Computing Society
Sponsored Session

Chair: Rajeep Raje, Indiana University, Dept of CIS, 723 West Michigan St., SL 280, Indianapolis, IN 46202-5132, rraje@cs.iupui.edu

1) **Experiences in Designing an Agent-Based System**, *Rajeep Raje*, Indiana University, Dept of CIS, 723 West Michigan St., SL 280, Indianapolis, IN 46202-5132, rraje@cs.iupui.edu, *Snehasis Mukhopadhyay*, *Mathew Palakal*

In the recent past, software agents have become very popular and have been deployed in many different domains. As attractive as these agents are, the design of an agent-based system is hardly trivial. We will briefly present the principles of agents and describe the design of a multi-agent system.

2) **A Metamodel & Semantics for Interoperating E-Businesses**, *Jie Xing*, North Carolina State University, EGRC 446, 1010 Main Campus Dr., jxing@eos.ncsu.edu, *Feng Wan*, *Sudhir K. Rustogi*, *Munindar P. Singh*

We develop an approach for interoperation among autonomous business entities. Interoperation is achieved via high-level interactions among agents that are given an operational semantics in terms of state charts. Thus, ideas from multi-agent systems and software engineering are combined and implemented using existing Java-based toolkits.

3) **InfoSpiders: Intelligent Software Agents for Managing Information on the Web**, *Filippo Menczer*, University of Iowa, MS Dept., S320 PBB, Iowa City, IA 52242, filippo-menczer@uiowa.edu, *Melania Degeratu*

Software agents that browse the Web autonomously, despite a slow response time, can complement search engines to improve their coverage and recency. The InfoSpiders system allows users to launch their own populations of intelligent, adaptive search agents on the Web. We discuss the implementation, efficiency and performance of agent-based online search.

TA34 Modeling Trade-Offs in Product Development Processes

Sponsor: Technology Management Section
Sponsored Session

Chair: David N. Ford, Texas A&M University, Dept. of Civil Eng., david.ford@ifi.uib.no

1) **Learning & the Outsourcing Decision**, *Edward G. Anderson*, University of Texas, Mgmt. Dept., CBA 4.202, Austin, TX 78712-1175, edanderson@mail.utexas.edu, *Geoffrey G. Parker*

Component outsourcing is a critical supply chain decision for any firm. Through outsourcing, firms can achieve lower unit costs, but may reduce their internal capacity for innovation. We present a model that attempts to capture the unit cost vs. learning opportunity trade-off for multiple markets.

2) **Adding Value in the Product Development Process**, *Tyson R. Browning*, Lockheed Martin TAS, tyson.browning@lmco.com

Ideally, a "lean" PD process will continuously add value. The value added by each PD activity depends on the benefits of its products and the costs of producing them. The value added by activities in a design process is explored with this theory.

3) **Performance of Coupled Product Development Activities with a Deadline**, *Ali A. Yassine*, MIT, Rm. E40-252, Cambridge, MA 02139, yassine@mit.edu, *Nitin Joglekar*, *Steven D. Eppinger*, *Daniel E. Whitney*

We explore the performance of coupled development tasks subject to a deadline constraint by proposing a performance generation model to develop insights about optimal strategies, i.e., sequential, concurrent, overlapping, etc., to manage coupled tasks that share a fixed amount of engineering resources subject to performance and deadline constraints.

4) **Iteration-Based Process Design of Concurrent Product Development Projects**, *David N. Ford*, Texas A&M University, Dept. of Civil Eng., david.ford@ifi.uib.no

Iteration caused by the quality and timing of information flows can delay product development. We integrate 2 existing models of the impact of upstream information quality, concurrence and downstream sensitivity on iteration and schedule performance in development projects. Development process design and policy alternatives are investigated.

TA35 Software Demonstration VI Software Demo Session

Chair: To be announced

1) **Imagine That, Inc.: Simulation Modeling with Extend**, *David Krahl*, Imagine That, Inc., 6830 Via Del Oro, Ste. 230, San Jose, CA 95119, davek@imaginethatinc.com

Come see why Extend(tm) is the acknowledged standard for discrete event and continuous simulation in top universities and corporations alike. See a demonstration of powerful Extend features such as top-down/bottom-up hierarchy, built-in activity-based costing, customizable animation, 1-click output analysis, automatic confidence intervals, sensitivity analysis, control panel interface, interactive model execution...

2) **SAS Institute, Inc.: The SAS System - What's New in Management Science Solutions**, *Edward P. Hughes*, SAS Institute Inc., SAS Campus Dr., Rm. 4109, Cary, NC 27513, ed.hughes@sas.com

The SAS System has recently greatly augmented its diverse array of OR and MS solutions. Many of these advances have occurred as part of our supply chain optimization initiative and illustrate how well our scheduling, optimization and other decision support capabilities can be integrated into interactive and Web-based solutions.

Tuesday 10:30-11:30

TP36 **Invited Plenary: Internet Technology at Western Governors University**
Invited Session

Chair: James J. Cochran, University of Cincinnati, QAOM Dept., PO Box 210130, Coll. of Bus. Admin., Cincinnati, OH 45221-0130, cochraj@econqa.cba.uc.edu

1) **Invited Plenary: Internet Technology at Western Governors University**, *Robert W. Mendelhall*, Western Governors University, 2040 East Murray Holladay Rd., Ste. 106, Salt Lake City, UT 84117, rwm@wgu.edu

Western Governors University (WGU) is a competency-based, degree-granting, online university that delivers cost-effective education using the Internet and other advanced telecommunications and networking technologies. Founded by the Governors of 19 western states, WGU's mission is to expand educational opportunities for learners everywhere by offering online access to classes from universities, colleges and corporate training programs through its unique online catalog. Current WGU degree offerings include: Associate of Arts, Associate of Applied Science in Network Administration, Associate of Applied Science in Electronics Manufacturing Technology, Associate of Applied Science in Software Applications Analysis & Integration and a Master of Arts in Learning & Technology. President Mendelhall will address the historical development, current status and future direction of WGU and how Internet technology is changing the paradigms of higher education as well as the implications for learning and teaching.

Tuesday 13:00-14:30

TC01 **Group Decision Making**

Sponsor: Decision Analysis Society
Sponsored Session

Chair: L. Robin Keller, University of California, Grad. Sch. of Mgmt., 350 GSM, Irvine, CA 92697-3125, lrkeller@uci.edu, http://www.gsm.uci.edu/~KELLER/

Co-Chair: Jayavel Sounderpandian, University of Wisconsin At Parkside, Dept. of Business, Kenosha, WI 53141-2000, sounderp@uwp.edu

1) **Virtual Groups & Private Preferences: Social Responsibility in the Information Age**, *Kathleen S. Hartzel*, Duquesne University, Palumbo Sch. of Bus., 802 Rockwell Hall, Pittsburgh, PA 15282-

0180, hartzel@duq.edu, *Nancy Paule Melone, Timothy W McGuire*

We investigate the effects of GSS, meeting structure and anonymity on the individual preferences, group decisions and social responsibility within a social dilemma framework. Personal preferences of majority and minority members were strongly influenced by the face-to-face group process but not significantly influenced by the computer-mediated process.

2) Guidelines for Mediating Brownfield Cleanup Negotiations, Jayavel Sounderpandian, University of Wisconsin at Parkside, Dept. of Business, Kenosha, WI 53141-2000, sounderp@uwp.edu, *Nancy Frank*

Brownfield cleanup projects need cooperation from the current owner of the site, the prospective buyer/developer and the local government. Guidelines are given for a mediator who is charged with finalizing a contingent contract among the 3 parties through negotiation. The guidelines use EU optimization.

3) Personal Self-Disclosure & Competitive & Cooperative Group Decision Making, Leah Dietz, Duke University, Fuqua Sch. of Bus., Box 90210, Durham, NC 27708-0210, ledietz@mail.duke.edu, *Susan E. Brodt*

We empirically studied how 3-person groups create and distribute resources, after having played a "getting acquainted" game or not. Results quantified the value of relational concern developed through self-disclosure, revealing an inverse relationship for competitive and cooperative contexts. Self-disclosure heightened self-interest in competitive contexts and heightened communal-interest in cooperative contexts.

4) Shifts in Willingness to Pay when Individuals or Pairs Face Ambiguous & Unambiguous Risky Choices, Rakesh K. Sarin, UCLA, Anderson Grad. Sch. of Mgmt., 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095-1481, rakesh.sarin@anderson.ucla.edu, *L. Robin Keller, Jayavel Sounderpandian*

Subjects expressed their willingness to pay for a 50% chance of winning \$100 and for a similar ambiguous gamble. They were then randomly paired and each pair expressed its willingness to pay for essentially the same gambles. The responses are analyzed for risky and safety shifts.

TC02 Multicriteria Decision Making II

Contributed Session

Chair: Freerk A. Lootsma, Delft University of Technology, Faculty ITS/TWI, Mekelweg 4, Delft, 2628 CD, The Netherlands, f.a.lootsma@its.tudelft.nl

1) Piecewise Quadratic Approximation of the Nondominated Set for Bicriteria Programs, Margaret M. Wiecek, Clemson University, Dept. of Math Sci., Clemson, SC 29634, wmalgor@clemson.edu, *Wei Chen, Jinhuan Zhang*

A procedure to approximate the nondominated set for bicriteria programs is proposed. The approximation is developed locally in a neighborhood of a nondominated point of interest which incorporates the decision maker's preferences and gives a closed-form description of the set.

2) Proper Efficiency & Cardinal Utilities in Multicriteria Decision Making, Zhimin Huang, Adelphi University, Sch. of Mgmt. & Bus., 1 South Ave., Box 701, Garden City, NY 11530, huang@panther.adelphi.edu, *Susan X. Li*

We investigate proper efficiency in MCDM when it is possible to represent the decision maker's risk attitudes and preferences by cardinal utilities. Proper efficiency is characterized by optimizing associated utility-related scalar optimization problems. More detailed relationships among proper efficiency, measure of risk aversion and allocation strategies are discussed.

3) Revision of Basic Concepts in Decision Analysis, Freerk A. Lootsma, Delft University of Technology, Faculty ITS/TWI, Mekelweg 4, Delft, 2628 CD, The Netherlands, f.a.lootsma@its.tudelft.nl

Given the progress of the life sciences, we must reconsider the concepts of decision analysis. Value functions are stair-case functions. Preferential independence is plausible within a given context only. Preferential transitivity is not plausible under low-dimensional criteria. Emotions are essential for decision making.

4) withdrawn - request of 3/31, Anke Leeuwerke, Delft University of Technology, Faculty ITS/TWI, Mekelweg 4, Delft, 2628 CD, The Netherlands

TC03 Modeling Aggregated-Force Attrition

Sponsor: Military Applications Society
Sponsored Session

Chair: James G. Taylor, Naval Postgraduate School, MOVES Academic Group, Monterey, CA 93943, jtaylor@nps.navy.mil

1) Hierarchy-of-Models Approach for Attrition in Large-Scale Ground Combat, Andrew G. Loerch, US Army, Ctr. for Army Analysis, Ft. Belvoir, VA 22060-5230, loerch@caa.army.mil, *James G. Taylor*

The state-of-the-art in both theory and practice for the hierarchy-of-models approach for modeling Lanchester-type attrition in large-scale ground combat is reviewed. Its strengths and weaknesses and consequent role in modeling joint warfare are discussed. Implications for current DoD programs are considered.

2) Federation of Combat Models, H. Kent Pickett, US Army, TRADOC Analysis Ctr., Ft. Leavenworth, KS 66027-2345, pickettk@trac.army.mil

An important alternative (linking models dynamically at run time) to the hierarchy-of-models approach of modeling large-scale combat is reviewed. Its genesis in new computer-science developments and the analytic importance of linking dynamically are discussed. Examples of its current use in analysis and staff training are given.

3) New Developments for Lanchester Attrition-Rate Coefficients, James G. Taylor, Naval Postgraduate School, MOVES Academic Group, Monterey, CA 93943, jtaylor@nps.navy.mil

Taylor's new methodological basis is reviewed for computing single-weapon-system-type kill rates for Lanchester-type combat models. The importance of target-engagement policies and their effect on fire distribution are examined. The place of these results within the context of options for modeling aggregated-force attrition is discussed.

TC05 Panel: Research Directions & Interesting Scheduling Problems

Cluster: Scheduling
Invited Session

Chair: Moshe Dror, University of Arizona, Coll. of Bus. & Public Admin., Dept. of MIS, Tucson, AZ 85721, mdror@mail.bpa.arizona.edu

1) Panel: Research Directions & Interesting Scheduling Problems, Michael L. Pinedo, NYU, Stern Sch. of Bus., 40 West 4th St., New York, NY 10012, mpinedo@stern.nyu.edu, *Jacek A. Blazewicz*, Politechnika Poznanska, Instytut Informatyki, ul. Piotrowo 3a, Poznan, 60-965, Poland, *Wieslaw Kubiak*, Memorial University of Newfoundland, Fac. of Bus. Admin., St. John's, NFL, A1B 3X5, Canada, wkubiak@kean.ucs.mun.ca, *Chung-Yee Lee*, Texas A&M University, 238 Zachry Bldg., Dept. of IE, College Station, TX 77843, cylee@acs.tamu.edu

This panel will present viewpoints by 4 leading researchers in the area of scheduling, focusing on the future of scheduling research. In particular, promising new research directions will be discussed and important open problems in scheduling will be introduced. Time will be allowed for open discussion.

TC06 Numerical Analysis in Service Design

Cluster: Service Design
Invited Session

Chair: Scott E. Sampson, Brigham Young University, Marriott Sch. of Mgmt., 660 TNRB, Provo, UT 84602, scott_sampson@byu.edu

1) Service Capacity Planning Implications of Revenue Management, Larry R. Weatherford, University of Wyoming, PO Box 3275, Laramie, WY 82071, lrw@uwyo.edu

RM is a commonly used tool in many of the service industries, i.e., airlines, hotels, rental cars, cruise lines, etc. The taxonomy of the RM problem will be explored and the implications of RM in the areas of capacity allocation, facility design and labor issues will be discussed.

2) Computer-Assisted Conference Design, Scott E. Sampson, Brigham Young University, Marriott Sch. of Mgmt., 660 TNRB, Provo, UT 84602, scott_sampson@byu.edu

The conference scheduling problem involves designing a timetable for a conference by assigning various sessions to specific time periods and rooms. Computers have been used to assist conference scheduling for many years. The primary use of computers in this context is data management. A secondary use is to track compliance with various scheduling constraints...

3) Service Recovery & Quality: An Exploratory Study, Kristie K. Seawright, Brigham Young University, Marriott Sch. of Mgmt., 660

TNRB, Provo, UT 84602, kristie_seawright@byu.edu, *Kristen Bell DeTienne*

In the first part of this study, we sought to determine the various components of service recovery. Analysis of more than 9,000 surveys indicated that there are both an operations component and a communications component in service recovery situations. In the second part, we studied the service recovery quality characteristics as they relate to success of recovery efforts...

4) Data Warehousing for Food Supply Chains, Jack C. Hayya, Pennsylvania State University, Beam BAB III, University Park, PA 16802, Chao-Hsien Chu, Xin He

To preserve quality and safety along a food supply chain, it would be necessary to build an online data acquisition and retrieval system such that the status of food products may be assessed. This requires the design of a data warehouse and the application of SPC and HACCP procedures.

TC07 Research & Development Contributed Session

Chair: K. Jo Min, Iowa State University, Dept. of IMSE, 2019 Black, Ames, IA 50011, jomin@iastate.edu

1) A Portfolio Selection Model for Financing R&D Activities, Simyoung Kwon, Pohang University of Science & Technology, San 31 Hyoja-dong, Nam-gu, Pohang, Kyungbuk, 790-784, Korea, bianca@postech.ac.kr, Keesung Kim, Jongho Park

The problem of optimally distributing resources among various R&D activities is formulated as an investment portfolio selection model. In our model, the basic research is not simply regarded as a risky investment opportunity but treated as an activity that may create a new investment opportunity.

2) Incentives for Voluntary Disclosure of Risk Information in Risk-Informed Regulation, Vicki Bier, University of Wisconsin, Mech. Engineering Bldg., 1513 University Ave., Rm. 451, Madison, WI 53706, bier@engr.wisc.edu, www.engr.wisc.edu/ie/faculty/bier_vicki.html

One barrier to implementing risk-informed regulation is the asymmetry in information between regulators and regulated parties. One solution is to provide incentives for voluntary disclosure of risks. Similar incentives have been extensively studied using game theory in regulatory economics. We will review this applicability of this work to risk-informed regulation.

3) Strategic Equilibrium for a Pair of Competing Servers with Discontinuous Cost, Duane Christ, Rutgers University, RUTCOR, 15 Tilton Dr., Freehold, NJ 07728, christ@rutcor.rutgers.edu, Benjamin Avi-Itzhak

Two servers compete for arriving customers that can balk. Each server selects a service rate that maximizes its own profit. Cost is discontinuous at the origin. The resulting 2-person game is shown to have from 0 to 3 pure strategy Nash equilibrium points depending on the startup cost.

4) Valuing Inter-Related Generation Planning Projects: A Real Options Approach, K. Jo Min, Iowa State University, Dept. of IMSE, 2019 Black, Ames, IA 50011, jomin@iastate.edu, Chung-Hsiao Wang

There have been numerous efforts to apply real options theory to generation planning projects. This has been encouraged by the on-going deregulation of electric power generation. We focus on the case of generation planning projects that are inter-related. Various inter-related cases will be examined and managerial insights will be presented.

TC08 Control of Queueing Networks & their Fluid Models Sponsor: Applied Probability Society

Sponsored Session

Chair: Nicole Baeuerle, University of Ulm, Dept. of OR, Ulm, 89069, Germany, baeuerle@mathematik.uni-ulm.de

1) Fluid Models for Systems with Setups: Convergence & Lower Bounds, Tava M. Lennon Olsen, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, tlennon@engin.umich.edu, http://www-personal.engin.umich.edu/~tlennon/, Wei-Min Lan

We consider single-server multi-class queueing systems with both setup times and costs. We derive a lower bound on the average production cost for the deterministic fluid system and show when the bound applies to stochastic systems. We also give results for when the stochastic system converges to the fluid system.

2) Average Optimal Policies in Piecewise Deterministic Markov Processes, Ulrich Rieder, Universitaet Ulm, Dept. of OR, Abteilung

Mathematik VII, Ulm, 89069, Germany

We consider the optimal control of piecewise deterministic Markov processes under the average cost criterion. Using the vanishing discount approach, we derive an average cost optimality inequality and prove the existence of optimal stationary policies under some assumptions. The results are applied to a queueing and a manufacturing system.

3) Flow Control for Service Facilities with Elastic Demand, Shaler Stidham, Jr., University of North Carolina, Dept. of OR, CB# 3180, Smith Bldg., Chapel Hill, NC 27599, sandy@email.unc.edu

We continue our analysis of service facilities in which the work submitted by a customer is elastic: the customer may be satisfied with completion of less than its potential work, depending on the current admission price and congestion. We consider the structure of dynamic policies for optimal flow control.

4) Stochastic Single-Server Fluid Networks, Nicole Baeuerle, University of Ulm, Dept. of OR, Ulm, 89069, Germany, baeuerle@mathematik.uni-ulm.de

We consider stochastic single-server fluid networks with feedback. Stochastic fluid models are systems with a deterministic dynamic that changes according to a stochastic process. We derive a stability condition for the single-server network and deal with the optimal scheduling problem. It turns out that the Gittens-index policy stochastically minimizes linear holding cost.

TC09 Logistics I Contributed Session

Chair: Syed Shahabuddin, Central Michigan University, 1306 East Preston, Mt. Pleasant, MI 48858-3929, 3m3eplg@cmich.edu

1) withdrawn - author request of 4/3, Li Yao, Chinese University of Hong Kong, Dept. of SE & EM, Hong Kong, Shatin NT, PR China, lyao@se.cuhk.edu.hk, Houmin Yan

2) Estimation of the Number of Transport Vehicles at a Container Terminal, Iris F. A. Vis, Erasmus University, Rotterdam Sch. of Mgmt., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, i.vis@fbk.eur.nl, http://www.fbk.eur.nl/FBK/VG6/ivis

To unload and load container ships quickly, new techniques which allow effective coordination of all activities at a terminal have to be developed. First, we discuss some decision problems. Furthermore, we present methods to solve the problem of the determination of the necessary number of transport vehicles.

3) Routing Vehicles On-Line with Forecasted Release Times to Approach Off-Line Performance, J. Robert Van der Meer, Erasmus University, Rotterdam Sch. of Mgmt., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, j.meer@fbk.eur.nl

On-line vehicle dispatching rules are compared with rules with some pre-arrival information on load release times and with rules that have all information in advance. It is shown that looking ahead about 1 to 2 jobs leads to significant performance gains and even approximates off-line performance.

4) Third Party Providers, Syed Shahabuddin, Central Michigan University, 1306 East Preston, Mt. Pleasant, MI 48858-3929, 3m3eplg@cmich.edu

Transportation of goods is becoming complicated as the number of small size suppliers and customers increases. Many companies are facing the dilemma of how to reduce the cost of transportation while serving the customers in a timely manner. As a result, many suppliers are using third party providers to achieve efficiency.

TC10 Supply Chain Management

Cluster: Supply Chain Management

Invited Session

Chair: Javad Seyed, North Carolina State University, 1933 Amity Hill Ct., Raleigh, NC 27612-2863, javad_seyed@ncsu.edu

1) Performance Measurement across the Supply Chain, Javad Seyed, North Carolina State University, 1933 Amity Hill Ct., Raleigh, NC 27612-2863, javad_seyed@ncsu.edu

Companies are using the latest innovations in IT and optimization methodologies to maximize their shareholders' value by improving on their efficiency and exceeding their customer's expectations. Performance measurements used for benchmarking how well a company achieves its objectives is measured in each department in a detached and solitary manner. Traditional performance measurements will be reviewed...

2) No Title Supplied, Mani Agrawal, Manugistics, Inc., 9200 East Panorama Cir., Ste. 200, Englewood, CO 80112, magrawal@manu.

com

A leading provider of supply chain solutions will introduce its solution set across the supply chain set including the latest development in the area of e-commerce. We also include a glimpse of the organization issues. The highlight is a detailed discussion of OR issues for e-commerce.

3) **No Title Supplied, Wei Tan**, Manugistics, Inc., 9200 East Panorama Cir., Ste. 200, Englewood, CO 80112, wtan@manu.com

Semiconductor production is rife with challenges to manufacturing and planning production activities. Complex flows, multiple products, repeated use of common equipment, high failure rates and maintenance requirements, restricted sourcing and high cost of production equipment demand the most sophisticated decision support tools. We try to identify supply chain management challenges and issues faced by semiconductor industries in the e-commerce era...

TC11 Recent Work in Experimental Design II

Sponsor: Quality, Statistics & Reliability

Sponsored Session

Chair: Theodore T. Allen, Ohio State University, Dept. of ISE, 1971 Neil Ave., Columbus, OH 43210-1271, allen.515@osu.edu

1) **Design & Analysis of an Unreplicated Three-Level Factorial Experiment for an Arrhenius Deposition Model for Semiconductor Contamination, John S. Ramberg**, University of Arizona, Dept. of SIE, Tucson, AZ 85721-0020, ramberg@sie.arizona.edu

A deposition model is postulated for a 3-parameter Arrhenius model characterizing copper deposition on silicon wafers in semiconductor manufacture. A 3-factor, 3-level, unreplicated experiment is used to estimate the parameters and validate the model. Several methods for analyzing unreplicated experiments, including classic pooling, Lenth's method and Berk & Picard's method, are illustrated and compared.

2) **Low Cost Alternatives to Simplex Designs based on Stochastic Optimization of the EIMSE Objective, Mikhail Bernshiteyn**, Ohio State University, Dept. of ISE, 1971 Neil Ave., Columbus, OH 43210, bernshiteyn.1@osu.edu, Theodore T. Allen

We present experimental methods for mixture experiments offering substantial cost savings and flexibility improvements compared with simplex designs. The methods derive from the EIMSE criterion, which has important advantages over the minimum bias objective, with the use of stochastic optimization. We illustrate the methods with a chemical engineering application.

3) **Minimum Bias Estimation & Minimum Bias Designs for Deterministic Computer Models, Douglas C. Montgomery**, Arizona State University, Dept. of IE, Tempe, AZ 85287-5906, doug.montgomery@asu.edu, Daniel R. McCarville

Optimization of outgoing product quality from a sequential measurement system is used to illustrate the utility of minimum bias estimation for deterministic computer models. Minimum bias designs are also generated for this model, assuming that the analyst wishes to protect against a general nonlinear response. An application in semiconductor manufacturing is presented.

4) **Further Developments Regarding the Minimum Bias Latin Hypercube Design, Kurt Palmer**, University of Southern California, Dept. of ISE, Los Angeles, CA 90089-0193, kpalmer@usc.edu

The MBLHD was developed for data collection from deterministic simulators. The existence of MBLHDs is investigated for all cases having a number of simulator runs between $N=4$ and $N=20$. Space filling properties of example designs are described. Examples of larger MBLHDs and designs involving integer variables are also given.

TC12 Network Models for Logistics Management

Cluster: Networks

Sponsor: Optimization Section

Sponsored Session

Chair: David Simchi-Levi, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, levi@iems.nwu.edu, http://www.iems.nwu.edu/~levi/

1) **Stochastic Network Flow Problems, Anton J. Kleywegt**, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, anton.kleywegt@isye.gatech.edu

The stochastic programming formulation of stochastic network flow problems retains the network structure in some cases, and in other cases, it does not. Some insight is provided into this behavior and algorithms and computational results are presented.

2) **Delivery Planning for Periodic LTL Shipments with**

Uncertain Demand, Anantaram Balakrishnan, Pennsylvania State University, 303 Beam Bldg., University Park, PA 16802-1913, anantb@psu.edu, **Michael Pangburn**

We address the delivery planning problem for a distributor making periodic and variable LTL shipments to retail stores. The model combines capacity planning, store grouping, truck routing and contingency planning (when truck capacity is exceeded) to minimize expected distribution costs. We report results for a real distribution operation using a GA solution procedure.

3) **A Review of Recent Results on the Effectiveness of the Zero-Inventory-Ordering Policy for Supply Chain Management, Zuo-jun Shen**, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, shen@iems.nwu.edu, **Lap Mui Chan, Ana Muriel, David Simchi-Levi, Chung Piaw Teo**

We analyze the problem faced by companies that rely on TL and LTL carriers for the distribution of products across their supply chain. The goal is to design inventory policies and transportation strategies minimizing system-wide cost structures. We study the cost effectiveness of restricting inventory policies to the class of 0-inventory-ordering policies in a single-warehouse multi-retailer scenario...

TC13 Diverse Applications of Metaheuristics

Cluster: Search in Combinatorial & Nonlinear Optimization

Invited Session

Chair: Bruce L. Golden, University of Maryland, Smith Sch. of Bus., Van Munching Hall, College Park, MD 20742, bgolden@rhsmith.umd.edu

1) **Extremal Optimization, A. G. Percus**, Los Alamos National Laboratory, MS B-265, Los Alamos, NM 87545, percus@lanl.gov

We propose a general-purpose heuristic for finding solutions to hard optimization problems, inspired by the far-from-equilibrium dynamics of self-organizing systems in nature. With only one adjustable parameter, the heuristic's performance proves competitive with, and often superior to, more elaborate stochastic optimization procedures. We demonstrate this on graph partitioning and other NP-hard problems.

2) **A Genetic Algorithm for Minimax Optimization Problems, Jeffrey W. Herrmann**, University of Maryland, Inst. for Systems Research, College Park, MD 20742, jwh2@eng.umd.edu

Robust discrete optimization finds a solution that has the best worst-case performance. We will present a GA designed to solve this type of minimax optimization problem. The algorithm has been applied to a minimax parallel machine scheduling problem and a minimax network design problem.

3) **Dynamic Multidimensional Fitness Functions for Genetic Algorithms for Classification Trees, Zhiwei Fu**, University of Maryland, Smith Sch. of Bus., Van Munching Hall, College Park, MD 20742, **Bruce L. Golden, Shreevardhan Lele, S. Raghavan, Edward A. Wasil, Jr.**

A GA creates diversity in candidate solutions via the operations of mutation and crossover. We propose a method to create additional diversity by using a multi-dimensional fitness function. In our experiments using GA to create optimal classification trees, we find that a focused univariate fitness function can be improved upon by a diversity-seeking bivariate fitness function.

4) **Solving the Traveling Salesman Problem with Demon Algorithms & Variants, Joshua W. Pepper**, Systems Planning & Analysis, Inc., 2000 North Beauregard St., Ste. 400, Alexandria, VA 22311, **Bruce L. Golden, Edward A. Wasil, Jr.**

Recently, several general optimization algorithms based on demon algorithms from statistical physics have been developed and tested on a few TSPs with encouraging results. We conduct an extensive computational study of 11 annealing-based heuristics, including demon algorithms, for the TSP.

TC14 Tutorial: Optimization in Medical Diagnosis & Treatment

Invited Session

Chair: Ariela Sofer, George Mason University, Dept. of Systems Eng. & OR, MS 4A6, Fairfax, VA 22030, asofer@gmu.edu, www.gmu.edu/departments/ore/sofer

1) **Tutorial: Optimization in Medical Diagnosis & Treatment, Ariela Sofer**, George Mason University, Dept. of Systems Eng. & OR, MS 4A6, Fairfax, VA 22030, asofer@gmu.edu, www.gmu.edu/departments/ore/sofer

In the past few years, optimization has emerged as a promising tool in solving medical diagnosis and treatment planning problems. However, because of the size and complexity of these problems, optimization is not yet used routinely in

clinical settings. This tutorial gives an overview of optimization in medical image reconstruction and radiation therapy planning. We discuss the problems, their associated models, existing solution methods and opportunities for future research.

TC15 Optimization Techniques I

Contributed Session

Chair: Maria A. Osorio, Autonomous University of Puebla, 1255 19th St. #2, Boulder, CO 80302, osorio@spot.colorado.edu

1) Random Restart Local Search Wins.....Eventually, Sheldon H. Jacobson, University of Illinois, Dept. of MIE, 1206 West Green St., MC 244, Urbana, IL 61801-2906, shj@uiuc.edu, www.staff.uiuc.edu/~shj/shj.html, **Enver Yucesan**

We show that for intractable discrete optimization problems, random restart local search is provably more effective (using a probability measure of visiting a global optima) than SA. This result holds as the number of restarts grows, even if SA is provably convergent. Implications of this result are discussed.

2) Modeling Illicit Drug Consumption: The Argument in Favor of Zero-Tolerance Policies, K. Chandrasekar Bhat, Taft-MRC Consultants, Box 124, Okemos, MI 48805-0124, Andrew K. Taft

Economists believe zero-tolerance policies that target recreational users will in fact boost drug consumption. We argue that zero tolerance will considerably inhibit drug consumption. The basis of our argument is a theoretical model that takes into account the effect of intimidated users on the rational behavior of drug dealers.

3) Diversification of Search Neighborhoods via Constraint-Based Local Search & its Application to Vehicle Routing, Hoong Chuin Lau, National University of Singapore, Sch. of Computing, 3 Science Dr. 2, 117543, Singapore, lauhc@comp.nus.edu.sg, www.comp.nus.edu.sg/~lauhc, **Yun Fong Lim, QiZhang Liu**

We propose a constraint-based approach for diversifying local search, a framework for iterative cooperation between a primal local search (minimizing objective while preserving feasibility) and our constraint-based diversification search (minimizing infeasibility while preserving objective). We apply this framework to the VRP with time windows and report its experimental performance.

4) Speeding up Simulations of Stochastic Linear Programs with Quasi-Control Variates, Markus Emsermann, University of Colorado, Dept. of Math., Box 173364, Denver, CO 80217, emserman@math.cudenver.edu

We estimate the expected value of the objective function of stochastic LPs with random right hand sides. We employ a dual approximation to the primal problem to improve simulation efficiency using QCVs. Applications to power system reliability evaluation will be presented.

5) Nesting Cuts for the Multi-Knapsack Problem, Maria A. Osorio, Autonomous University of Puebla, 1255 19th St. #2, Boulder, CO 80302, osorio@spot.colorado.edu, **Peter L. Hammer, Fred W. Glover**

We add global cuts to the multi-knapsack problem before B&B. After getting a surrogate using dual LP values, we pair the surrogate and the objective function to get logic cuts from the paired inequality. With any integer solution and the cuts generated, we get nested cuts from the objective function.

TC16 Routing & Scheduling of Vehicles & Crews

Sponsor: Transportation Science Section

Sponsored Session

Chair: Guy Desaulniers, GERAD, Ecole Polytech., 3000 Cote-Sainte-Catherine, Montreal, Quebec, H3T 2A7, Canada, guyd@crt.umontreal.ca

1) Simultaneous Vehicle & Crew Scheduling in Urban Mass Transit: Recent Results, Guy Desaulniers, GERAD, Ecole Polytech., 3000 Cote-Sainte-Catherine, Montreal, Quebec, H3T 2A7, Canada, guyd@crt.umontreal.ca, **Jacques Desrosiers, Bryan Villeneuve, Knut Haase**

We consider the problem of simultaneously scheduling buses and drivers at minimum cost. We present new computational results obtained by modifying a previous formulation which involves only driver variables. The modified formulation is solved by a column generation approach and optimal bus schedules are derived a posteriori in polynomial time.

2) A Branch & Cut Algorithm for the Multiple Depot Vehicle Scheduling Problem, Ahmed Hadjar, GERAD, Ecole Polytech., 3000 Cote-Sainte-Catherine, Montreal, Quebec, H3T 2A7, Canada,

hadjar@crt.umontreal.ca, **Odile Marcotte, Francois Soumis**

The algorithm we describe is exact and combines column generation, variable fixing procedures and cutting planes. We present computational results for problems involving up to 500 nodes and we compare several strategies, i.e., variable fixing, tree exploration, branching and cutting planes.

3) Perspectives & Prospects in Crew Scheduling, Guy Desaulniers, GERAD, Ecole Polytech., 3000 Cote-Sainte-Catherine, Montreal, Quebec, H3T 2A7, Canada, guyd@crt.umontreal.ca, **Jacques Desrosiers, Marius M. Solomon, Francois Soumis**

We offer several perspectives on the design, development and implementation of successful crew scheduling systems. We highlight mathematical aspects of the models and solution techniques utilized to illustrate how these are being extended by current research to model and solve important new problems.

TC17 Route Guidance

Sponsor: Transportation Science Section

Sponsored Session

Chair: Srinivas Peeta, Purdue University, Sch. of Civil Eng., 1284 Civil Eng. Bldg., West Lafayette, IN 47907-1284

1) Internet-Based Cluster Computing Architecture for Real-Time Routing Operations, Srinivas Peeta, Purdue University, Sch. of Civil Eng., 1284 Civil Eng. Bldg., West Lafayette, IN 47907-1284, **Raghubhushan Pasupathy, Shyam Gedela**

A Web-based control architecture for generating route guidance strategies for on-line implementation in traffic networks equipped with ATIS/ATMS is discussed. On-line issues in this context are addressed.

2) On-Line Driver Behavior Modeling vis-a-vis Route Guidance, Jeong Whon Yu, Purdue University, Sch. of Civ. Eng., 1284 Civil Eng. Bldg., West Lafayette, IN 47907-1284, **Srinivas Peeta**

A fuzzy logic-based model is proposed to efficiently capture the on-line factors that influence driver behavior for under route guidance.

3) An Internet-Based User Survey for Driver Behavior under Variable Message Signs, Jorge Ramos, Purdue University, Sch. of Civ. Eng., 1284 Civil Eng. Bldg., West Lafayette, IN 47907-1284, **Srinivas Peeta**

We compare Internet-based surveys with those of the traditional on-site and mail-back user surveys, in the context of analyzing driver behavior under variable message signs. The Borman Expressway corridor in northern Indiana is used as a case study.

TC18 Panel: Best Cases

Sponsor: INFORM-ED

Sponsored Session

Chair: Peter C. Bell, University of Western Ontario, Ivey Sch. of Business, London, Ontario, N6A 3K7, Canada, pbell@ivey.uwo.ca

1) Best Cases, Thomas A. Grossman, University of Calgary, Fac. of Mgmt., 2500 University Dr. NW, Calgary, Alberta, T2N 1N4, Canada, grossman@ucalgary.ca

Several presenters will discuss cases that have proven effective in teaching their OR/MS course. Sample cases and, where possible, teaching notes will be made available to attendees.

TC19 OR/MS in Forestry III

Cluster: Forestry

Sponsor: ENRE

Sponsored Session

Chair: Susan L. King, USDA Forest Service, Northeastern Research Station, 11 Campus Blvd., Newton Square, PA 19073, sking/ne_fia@fs.fed.us

1) Optimal Silvicultural Scheduling for Wildlife Objectives: Incorporating Spatial Population Dynamics in a Genetic Algorithm, Clinton T. Moore, University of Georgia, GA Coop. Fish & Wildlife Unit, Warnell Sch. Forest Resources, Athens, GA 30602, cmoore@smokey.forestry.uga.edu, **Michael J. Conroy, Kevin Boston**

Spatially-explicit population dynamics often regulate the abundance of forest wildlife species. Such processes may affect the optimal arrangement of silvicultural activities for wildlife population objectives. We demonstrate a GA for seeking silvicultural schedules that maximize the expected abundance of a forest bird responding to stochastic and spatially-explicit population dynamics.

- 2) **Comparing Vegetation Indexes used to Map Forest Cover in Complex Urban Landscapes**, *Michael L. Hoppus*, USDA Forest Service, Northeastern Research Station, 11 Campus Blvd., Newton Square, PA 19073, mhoppus/ne_fia@fs.fed.us, *Rachel Riemann*

Vegetation indices were used to extract forested land vs. non-forested land from a late August TM scene of Connecticut. Forest-non-forest maps produced using the normalized difference vegetation index, Kauth-Thomas tasseled cap layers and principal component 2 compared favorably with supervised and unsupervised classification techniques. Accuracy assessment used 500 US forest Service Inventory Analysis ground plots.

- 3) **Comparing Linear, Nonlinear & Nonparametric Models for Stratification & Prediction in Forest Inventories of the Intermountain West**, *Gretchen G. Moisen*, USDA Forest Service, Rocky Mt. Research Station, 507 25th St., Ogden, UT 84401, gmoisen/rmrs_ogdenfsl.fs.fed.us

Six modeling techniques are compared for merging forest inventory data with satellite-based information over 6 ecoregions in the Intermountain West. Models are used to improve efficiency in estimates of population totals through stratification and to produce regional maps of continuous and discrete forest variables.

- 4) **A Comparison of Moving Average, Imputation & Growth & Yield Models for an Annualized Inventory in the Northeast**, *Susan L. King*, USDA Forest Service, Northeastern Research Station, 11 Campus Blvd., Newton Square, PA 19073, sking/ne_fia@fs.fed.us

In an annual forest inventory of a state, only a subset of the plots are remeasured each year. Estimates of forest resources must be reported yearly. Methods of accounting for the missing observations include: moving average, imputation and growth and yield models. These methods will be compared for trees in the Northeast.

TC20 Limit Behavior of Queues

Cluster: Math Modeling/Stat Inference/Comp Methods in Queueing System
Invited Session

Chair: Tim Zajic, University of Minnesota, Inst. for Math. Applications, 400 Lind Hall 207 Church St SE, Minneapolis, MN 55455, zajic@ima.umn.edu

- 1) **Limit Theorems for Queues with Scheduled Arrivals**, *Peter W. Glynn*, Stanford University, Dept. of EES & OR, Stanford, CA 94305-4023, glynn@leland.stanford.edu, *Hong Chen*, *Yijun Zhao*

Traditional queueing theory assumes that customers arrive via a renewal-like point process. When aircraft arrive at an airport, the arrival epochs display more regularity. We contrast the limit behavior of such a queue with that predicted by the traditional model.

- 2) **Waiting Time Asymptotics for Multiserver, Nonstationary Jackson Networks with Abandonment**, *William A. Massey*, Bell Labs., Lucent Technologies, Math Science Research Ctr., 600 Mountain Ave., 2C-320, Murray Hill, NJ 07974-0636, will@resarch.bell-labs.com, *A. Mandelbaum*, *Martin I. Reiman*, *B. Rider*, *Alexander L. Stolyar*

The fluid and diffusion limits obtained for Jackson networks with multiserver nodes, abandonment and time-varying rates (based on a paper by Mandelbaum, Massey & Reiman) can be extended to obtain similar types of limit theorems for the virtual FCFS-waiting times at every node in the network. We can then obtain simple numerical algorithms to estimate the virtual waiting time at any node.

- 3) **Large & Moderate Deviation Asymptotics for Many-Server Queues**, *A. Puhalskii*, University of Colorado, Math. Dept., CB 170, PO Box 173364, Denver, CO 80217, puhalski@math.cudenver.edu

We study logarithmic asymptotics of large and moderate deviation probabilities for the process of the number of customers in a many-server queue with intensive arrivals. We consider 2 asymptotic regimes: the Iglehart-Borovkov regime when the number of servers is much greater than the arrival rate and the Halfin-Whitt regime when these 2 quantities are of the same order.

- 4) **Rough Asymptotics for Tandem Non-Homogeneous M/G/infinity Queues via Poissonized Empirical Processes**, *Tim Zajic*, University of Minnesota, Inst. for Math. Applications, 400 Lind Hall 207 Church St SE, Minneapolis, MN 55455, zajic@ima.umn.edu

We obtain large and moderate deviations principles for the joint distribution of the queue length and departure processes for tandem M/G/infinity queues. The results follow from large and moderate deviations principles for Poissonized empirical processes. As an application, we study how large queue lengths and numbers of departures build up.

TC21 Industry Applications I

Contributed Session

Chair: Lawrence G. Chorn, Real Options Software, PO Box 420296, Dallas, TX 75207, lgc@roce-inc.com

- 1) **Empirical Evaluation of Exponential & Independence Assumptions in Queueing Models of Manufacturing Systems**, *Robert Inman*, General Motors R&D Center, 30500 Mound Rd., MC 480-106-359, Warren, MI 48090, rinman@gmr.com

We present processing, failure, repair and interarrival time data from 2 automotive welding lines. Besides providing a sampling of the randomness actually found in industry, we assess the validity of some common exponential and independence assumptions; assumptions which are motivated primarily by mathematical convenience.

- 2) **Economic & Engineering Constraints on the Restructuring of the Electric Power Industry: Consideration of Real-Power Gaming**, *Verne W. Loose*, Los Alamos National Laboratory, PO Box 1663, MS F604, Los Alamos, NM 87545, vw@lanl.gov, *Jonathan Dowell*

Restructuring the electric power industry seeks to replace local regulated monopolies by introducing competition between generators of electric power. Competition has been introduced in several US markets, but gaming, one-of-a-kind resources and localized phenomena provide practical limits to competition. We examine competition constraints with real-power-gaming and reactive-power-ancillary-services examples.

- 3) **An Efficient Algorithm for Tolerance Improvement through Selective Assembly**, *Akachai Jantayavichit*, University of Wisconsin, Dept. of IE, 1513 University Ave., Madison, WI 53706, jantayav@cae.wisc.edu, *Arne Thesen*

Selective assembly using efficient matching algorithms can produce assemblies meeting tolerance requirement superior to those of their components. Matching algorithms for high speed assembly of automotive components and batch assembly of more complex parts are proposed. Recommendations for different applications are made.

- 4) **The Intelligent Strategy Making Process for Automated Negotiation Systems**, *Se-Jin Park*, Korea University, Dept. of IE, 5-1 Anam-dong, Sungbuk-ku, Seoul, 136-701, Korea, sjpark.kr@hotmail.com, <http://cim.korea.ac.kr>, *Jin Jun*, *SungSchick Kim*

Distributive bargaining in negotiation has been widely discussed in many theoretical and practical domains. We propose the methodology of the strategy making process by using the machine learning technique in an automated negotiation system and describe the process and framework of negotiation. The intelligent strategy making process is implemented by competitive learning.

- 5) **Practical Real Options Structures for Capital Budgeting**, *Lawrence G. Chorn*, Real Options Software, PO Box 420296, Dallas, TX 75207, lgc@roce-inc.com

Capital budgeting decisions are rarely 1-step events. Managers face contingent decisions in multi-year investments. Applying real options to these decisions requires a framework to mimic the contingent character of the investment. We extend the real options literature by discussing commonly observed real options structures in capital budgeting.

TC22 Knowledge & Technology I

Cluster: Knowledge & Technology
Invited Session

Chair: Deb Armstrong, University of Utah

- 1) **Knowledge Configuration & Engagement: Understanding Knowledge Sharing Practices in Dispersed Groups**, *Deborah Sole*, Harvard Business School, Boston, MA 02163

A case study of knowledge sharing practices in dispersed groups is presented. It explores how the nature of a group's knowledge (knowledge configuration) interacts with the way group members engage their individual and collective knowledge in the resolution of knowledge-intensive issues (knowledge engagement). Implications for collaborative performance are discussed.

- 2) **Revisiting Shared Knowledge: The Impact on IS Organization Maturity**, *Kay Nelson*, University of Utah, Sch. of Accounting, 1645 East Campus Dr., Rm. 108, Salt Lake City, UT 84112, actkn@business.utah.edu

In a 1996 study published in MIS Quarterly, Nelson & Coopridge found that shared knowledge between IS groups and their line partners had a positive impact on IS group performance. Since then, a number of studies has been performed in organizations seeking IS process maturity through the SEI/CMM framework. We discuss whether shared knowledge has been a significant

contributor to IS process and organizational maturity.

3) Transferring Business Domain Knowledge during Technological Transition, Mari Buche, University of Kansas

This case study highlights the transference of business domain knowledge during periods of technological transition within in-house IT shops. As technology continues to change at a rampant pace, companies react by impulsively replacing experienced workers with individuals recently trained in innovative technological tools and techniques. Management actions are motivated by the perception that experienced workers possess obsolete tools...

4) withdrawn: chair request of 3/27, Mehdi Ghods, The Boeing Company, PO Box 24346, Seattle, WA 98124

TC23 Energy Issues

Cluster: Energy

Sponsor: ENRE

Sponsored Session

Chair: Steven A. Gabriel, ICF Consulting Group/George Washington University, 9300 Lee Highway, Fairfax, VA 22031-1207, sgabriel@icfconsulting.com

1) Price Processes for Electric Power, Robert L. Earle, The Brattle Group, 1133 20th St. NW, Ste. 800, Washington, DC 20036

The electric power industry is undergoing a restructuring of its generation or energy producing component exposing market participants to new forms of risk. Optimal investment, operations and contracting decisions require specification of the processes underlying spot and forward prices. We explore the theoretical and empirical bases of these processes and examine their applications to some operational decisions.

2) A Non-Optimal Solution Procedure for an Aggregate Natural Gas Transportation Forecasting Model, Joe Benneche, Energy Information Administration, US Dept. of Energy, 1000 Independence Ave. SW, Washington, DC 20585, Elizabeth May

The EIA's National Energy Modeling System (NEMS) is a computer-based, energy-economy modeling system of US energy markets for the midterm period through 2020. The Natural Gas Transmission & Distribution Model is the component of the NEMS used to determine the flow, capacity and associated prices of natural gas through the major pipeline corridors of the US and Canada...

3) An Analytic Resource Assessment Method for Unconventional Oil & Gas Accumulations, Robert A. Crovelli, US Geological Survey, Denver Federal Ctr., PO Box 25046, MS 939, Denver, CO 80225, crovelli@usgs.gov

The ACCESS (Analytic Cell-based Continuous Energy Spreadsheet System) petroleum resource assessment method was developed from analytic probabilistic methodology to calculate estimates of technically recoverable crude oil and natural gas resources for unconventional petroleum accumulations in assessment units that will comprise a new national oil and gas assessment of the US.

4) Solving an Intertemporal, Interregional Equilibrium for the North American Natural Gas Market, Steven A. Gabriel, ICF Consulting Group/George Washington University, 9300 Lee Hwy, Fairfax, VA 22031-1207, sgabriel@icfconsulting.com, Julio Manik, Shree Vikas

We present computational strategies for determining equilibrium prices, quantities and flows of gas in a large-scale model of the North American natural gas system. This model uses reservoir-level data to build up supply curves from the "bottom up" and is based on maximizing producer plus consumer surplus subject to network and other realistic constraints. We provide details on an iterative approach that makes use of successive LP.

TC24 Decision Models for Reuse

Cluster: Green Manufacturing

Invited Session

Chair: Rommert Dekker, Erasmus University, Econometrics & OR Dept., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, rdekker@few.eur.nl

1) The Holding Cost Strategic Role to Optimize a Decision Model in a Remanufacturing Process, Teresa Murino, University of Naples "Federico II", Fac. of Eng., Corso Vittorio Emanuele 110/2, Naples, 80121, Italy, murino@unina.it, Liberatina Santillo, Ilenia Tamasi

Traditional techniques for the reduction and elimination of waste change: how are products manufactured? Remanufacturing is an environmental choice as well as a real market opportunity. We discuss factors that lead to select a decision

between push and pull inventory control. Our aim is to verify, in the economic feasibility analysis phase, the holding cost factor which promotes or limits the successful introduction and implementation of the remanufacturing process.

2) On the Effect of Uncertainty in Product Recovery Network Models, Ovidiu Listes, Erasmus University, Econometrics & OR Dept., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, Rommert Dekker

We outline existing approaches for the design and analysis of product recovery networks. Most of them treat the problems with deterministic location techniques, yet, a recent review of the practice of product recovery networks reveals that uncertainty is a major issue in setting up such a network. We show which techniques can be applied to model uncertainty in product recovery networks...

3) Economic Ordering Quantities for Inventory Systems with Reverse Logistics, Ruud H. Teunter, University of Magdeburg, Fac. of Economics & Mgmt., Dept. of Prod. & Logistics, Magdeburg, 39016, Germany, teunter@ww.uni-magdeburg.de

Systems with reverse logistics are more complex than systems with only forward logistics. As a consequence, they are also more difficult to control. A control policy more suited for stochastic environments is defined. Different methods for setting the inventory holding cost rates are compared. EOQs for manufacturing and remanufacturing are derived and tested in a model with 0 lead times and stochastic demands and returns.

TC25 Business-to-Business E-Commerce

Cluster: Business-to-Business E-Commerce

Invited Session

Chair: Michael J. Shaw, University of Illinois, Dept. of Business Admin., 350 Commerce West, Champaign, IL 61820, m-shaw2@uiuc.edu

1) Economic Returns to Firms from Business-to-Business Electronic Commerce Initiatives: An Empirical Examination, Mani Subramani, University of Minnesota, Dept. of Info & Dec. Sci., Carlson Sch. of Mgmt., Minneapolis, MN 55455, msubramani@csom.umn.edu, Eric Walden

Do firms derive economic returns from B2B initiatives? How do returns to startup firms compare to those for established firms in B2B initiatives? How do returns to B2B initiatives around digital goods compare to those involving tangible goods? We examine these questions empirically using event study methodology.

2) Business Communication Languages: EDI, XML & Semantics, Wilhelm Hasselbring, Tilburg University, Infolab, Fac. of Economics, PO Box 90153, Tilburg, 5000 LE, The Netherlands, hasselbring@kub.nl, Hans Weigand

A main problem for B2B e-commerce is the need for the involved ISs to meaningfully exchange information. Traditional EDI isn't sufficient to solve those problems in an open, dynamic environment. We discuss XML as the practical foundation for structuring as well as the use of speech-act semantics, shared terminologies, ontologies and public component libraries for formally specifying the semantics.

3) Banks as Intermediaries in Small Business-to-Business Electronic Commerce, Gerhard Steinke, Seattle Pacific University, Seattle, WA 98119, gsteinke@spu.edu, Mareike Schoop

One way to promote e-commerce among small businesses is by the availability of an intermediary e-commerce system. This system could provide a variety of value-added services, assurances and security to support small businesses in their adoption of e-commerce. We suggest capabilities and features that an e-commerce system managed by an intermediary party could include...

4) Trust in Business-to-Business Electronic Commerce, Matthew K. O. Lee, City University of Hong Kong, Hong Kong, ismatlee@cityu.edu.hk, Efrain Turban

In B2B e-commerce, the level of dynamisms and uncertainties is much higher. Yet, the potential benefits to an organization depend critically on whether there is a large enough critical mass of organizations willing to engage in B2B e-commerce. We explore the nature of trust in B2B e-commerce by examining the role trust plays in a number of typical business models...

TC26 Tutorial: Realistically Modeling Transportation Costs

Sponsor: Section on Logistics
Sponsored Session

Chair: Bruce Ferrin, Western Michigan University, Dept. of Mktg., Haworth College of Bus., Kalamazoo, MI 49008-3812, bruce.ferrin@wmich.edu

1) Tutorial: Non-Linear Transportation Cost Functions & Lot Sizing, Bruce Ferrin, Western Michigan University, Dept. of Mktg., Haworth College of Bus., Kalamazoo, MI 49008-3812, bruce.ferrin@wmich.edu

We explore pragmatic environmental characteristics, such as shipment distance and shipment quantity, that generate non-linearity in transportation cost functions. In addition, current regulation and carrier pricing systems will be examined. The impact of non-linear transportation cost functions on lot sizing decisions will be demonstrated.

TC27 Finance & Risk Management I
Contributed Session

Chair: Susan Lash, Country Mutual Insurance, 1701 Towanda Ave., Bloomington, IL 60701, sslash23@aol.com

1) The Method of Multiple Probability Measures in Portfolio Selection: Growth Optimal One Period & Continuous Time Models, Craig A. Friedman, Morgan Stanley & Co., 115 West 86th St., #11C, New York, NY 10024, cfried@ms.com

We examine various portfolio allocation problems where the asset probability measure is not known with certainty but lies in a predefined set of probability measures. This set may encompass different temporal regimes, different forecasting techniques, etc. We provide practical methods to specify sets of measures and compute optimal portfolios.

2) Disjunctive Programs for Balance Sheet Optimization, Katherine G. Wyatt, CUNY Brooklyn College, Logic Based Systems Lab, 102 Third Pl., Brooklyn, NY 11231, wyatt@sci.brooklyn.cuny.edu, <http://www.sci.brooklyn.cuny.edu/~wyatt>

Financial institutions optimize portfolios in reference to risk management goals, accounting standards and financial analysts' expectations. We present MIP formulations of portfolio optimization that take market and pricing models results as input and that express specific accounting standards and risk management goals in disjunctive constraints. Experimental results are presented.

3) An Algorithm for a Portfolio Selection Model, Ki Young Shin, Hanyang University, Dept. of IE, Ansan, Kyunggi-do, 425-791, Korea, sky@mecors.hanyang.ac.kr, **Yong Chan Kim, Jong Soo Kim**

We propose an algorithm that generates a very good integer solution in a reasonable amount of time. The algorithm is tested using real Korean stock market data.

4) Dynamic Financial Modeling for Property Casualty Insurers, Susan Lash, Country Mutual Insurance, 1701 Towanda Ave., Bloomington, IL 60701, sslash23@aol.com

P/C finances are composed of a series of complicated, intertwined cash flows. DFA modeling helps insurers project the results of today's decisions before they are made. The DFA concept broadens the scope of the company's analysis to encompass the entire balance sheet as well as the company's business plan.

TC28 Integer Programming Techniques to Real Applications

Cluster: Computational Mixed Integer Programming
Invited Session

Chair: Eva K. Lee, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, eva.lee@isye.gatech.edu

1) Matrix Reduction Techniques for Dense MIPs & their Application to Radionuclide Implants for Prostate Cancer, Eva K. Lee, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, eva.lee@isye.gatech.edu

2) An Improved Cutting-Plane Algorithm for the Vehicle Routing Problem with Time Windows, Jennifer Rich, Aspen Technology, Inc., Chesapeake Supply Chain Div., 10575 Katy Freeway, Ste. 350, Houston, TX 77024, jennifer.rich@aspentech.com, **William Cook**

3) Robust Airline Crew Scheduling, Andrew J. Schaefer, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, schaefer@isye.gatech.edu, **Ellis L. Johnson, Anton J. Kleywegt, George L. Nemhauser**

TC29 Managing Product Variety II

Cluster: Managing Product Variety
Invited Session

Chair: Ajay K. Mishra, SUNY, Sch. of Mgmt., Binghamton, NY 13902, amishra@binghamton.edu

1) The Component Commonality Problem with Non-Identical Lead-Times, Serguei Netessine, University of Rochester, Simon Grad. Sch. Bus. Admin., Rochester, NY 14627, netessine@ssb.rochester.edu, ssb.rochester.edu/phdresumes/netessine/, **Nils Rudi**

We study a model of 2 products where (common and specific) components are acquired to inventory and products are assembled to order. We model and study the case when the lead-time for the common components is different from the lead-time for the specific components which represents several real-world situations.

2) The Costs & Benefits of Component Commonality in a Variety of Multiple-Period Models, Mark S. Hillier, University of Washington, MS Dept., Sch. of Business Admin., Seattle, WA 98195, mhillier@u.washington.edu

The risk-pooling benefits of commonality can quickly become dominated by higher purchase/production costs of a common component in multiple-period models. We consider environments such as non-identical lead times, correlated demand, highly variable demand and the simultaneous use of common and unique components where the benefits outweigh the costs, even in the multiple-period case.

3) Commonality & Postponement Policies for Components with Rank-Ordered Functionality, Siki Timucin, Stanford University, Dept. of MSE, Stanford, CA 94305-4024, timucin@stanford.edu, **Margaret L. Brandeau**

We consider the problem of determining the level of functionality of components and determining their points of differentiation in the supply chain. We consider production, setup, inventory holding and postponement costs. We characterize the optimal solution and analyze the sensitivity of the solution to problem parameters.

4) The Multiple Product-Single Common Component Model, Ajay K. Mishra, SUNY, Sch. of Mgmt., Binghamton, NY 13902, amishra@binghamton.edu, **Prakash Mirchandani**

We study an assemble-to-order model for multiple products with product-specific components and one common component. The objective is to minimize the sum of component acquisition costs and expected holding costs on excess components and shortage costs on unsatisfied demand. We obtain analytical bounds and computational results for this problem.

TC30 Operations Planning in Agile Assembly Centers

Sponsor: MSOM

Sponsored Session

Chair: Benoit Montreuil, Universite Laval, CENTOR Research Ctr., Quebec, Quebec, G1K 7P4, Canada, benoit.montreuil@centor.ulaval.ca

1) Enabling Throughput Flexibility in Complex-Products Assembly Centers, Anass Jabiri, Universite Laval, CENTOR Research Ctr., Quebec, Quebec, G1K 7P4, Canada, anass.jabiri@centor.ulaval.ca, **Benoit Montreuil**

Assembly centers responsible for complex products are characterized by multi-worker stations with long cycle times. They produce a limited number of product units per week. Often, they are restricted to operate during a single shift, due to the difficulty of passing remaining work to another team at shift changeover time...

2) Promising Delivery Dates to Clients in Long-Cycle Assembly Centers, Chafik Abid, Universite Laval, CENTOR Research Ctr., Quebec, Quebec, G1K 7P4, Canada, chafik.abid@centor.ulaval.ca, **Sophie D'Amours, Benoit Montreuil**

Assembly centers producing large parameterized products requiring long cycle times often have significant delivery lead times. Clients have to order products up to months ahead of time. Each client has a preferred delivery window, distinct priority and a parameterized ordered products of given complexity, requiring a set of purchased components...

3) Planning Operations in Small Agile Assembly Centers, Alain Beaulieu, SET Technologies, Inc., Ste.-Foy, Quebec, G1X 4M8, Canada, alain.beaulieu@set.qc.ca, **Benoit Montreuil, Stephane Desrosiers, Francois Boutet**

Small agile assembly centers have to support short delivery lead times, large numbers of small orders and highly parameterized products. In order to master their agility requirements, they use time-varying staffing, varying staff

assignments to workstations, varying operations assignments to workstations, kanban and WIP control policies and auto-organization principles....

4) An Agile Complex-Product Assembly Line Planning Framework, Benoit Montreuil, Universite Laval, CENTOR Research Ctr., Quebec, Quebec, G1K 7P4, Canada, benoit.montreuil@centor.ulaval.ca, *Alain Beaulieu*

Most research on assembly line balancing, planning and design focuses on fast-paced short-cycle-time assembly. Assembly of large, complex parameterized products requiring hundreds of person-hours, requires a different framework to support their design, planning and balancing. We introduce such a framework, emphasizing the variety of entities and issues that have to be taken into consideration...

TC31 Issues in Supply Chain Planning & Design

Sponsor: MSOM

Sponsored Session

Chair: Charles R. Sox, Auburn University, Dept. of ISE, 207 Dunstan Hall, Auburn, AL 36849, crsox@eng.auburn.edu

1) Long-Term & Short-Term Robust Capacity Planning, Uday S. Rao, Carnegie Mellon University, GSIA 208, Schenley Park, Pittsburgh, PA 15213, urao@andrew.cmu.edu, *Sunder Kekre, Samarth Sarthi, Jinxin Yi*

Capacity planning under uncertain demand is of strategic and tactical importance. For this problem, we develop a general integrated modeling framework. For a special case, motivated by an industrial application, we investigate the effects of uncertainty on optimal decisions and expected long- and short-term costs, under different risk measures.

2) A Simulation Model for Studying Capacity Management in Service-Oriented Supply Chains, Edward G. Anderson, University of Texas, Mgmt. Dept., CBA 4.202, Austin, TX 78712-1175, edanderson@mail.utexas.edu, *Douglas J. Morrice*

We present a simulation model of a service-oriented supply chain in which each stage holds no finished goods inventory. Rather, order backlogs are only managed by adjusting capacity. We describe results from using the model to teach capacity management skills in a service supply chain. In addition, we discuss how the model can address various research questions in supply chain optimization.

3) Determining the Optimal Supply Chain Structure for a Hospital Network, Sean P. Willems, University of Cincinnati, Dept. QAOM, Coll. Bus. Admin., 531 Lindner Hall, Box 210130, Cincinnati, OH 45221-0130, sean.willems@uc.edu, http://homepages.uc.edu/~willems/

We present an optimization model that determines how to reconfigure a 3-company supply chain consisting of a manufacturer, distributor and hospital network. We discuss the challenges inherent in examining multi-company supply chains and propose techniques to solve them. We show that changing payment terms incentivizes the distributor to participate in the restructuring.

4) Adaptive Supply Chain Planning & Control, Charles R. Sox, Auburn University, Dept. of ISE, 207 Dunstan Hall, Auburn, AL 36849, crsox@eng.auburn.edu, *James T. Treharne, Srinivas Kambhamettu*

Supply chain planning and control is often complicated by uncertain, non-stationary demand that results in a highly dynamic system. We present a framework for modeling and analyzing these systems. Insights regarding the use and value of information in these systems are compared with related industrial experience in a specific supply chain.

TC32 Tutorial: Agents & Information Filtering

Sponsor: Computing Society

Sponsored Session

Chair: Rajeev Raje, Indiana University, Dept of CIS, 723 West Michigan St., SL 280, Indianapolis, IN 46202-5132, rraje@cs.iupui.edu

1) Tutorial: Agents & Information Filtering, Rajeev Raje, Indiana University, Dept of CIS, 723 West Michigan St., SL 280, Indianapolis, IN 46202-5132, rraje@cs.iupui.edu

Agents have gained substantial popularity in the past 6-8 years. They present an exciting paradigm to realize many web-based complex applications. We will briefly present the principles of multi-agent computing, discuss examples of information filtering agents and describe the design of the multi-agent filtering system developed at Indiana University Purdue University Indianapolis.

TC33 Bounds & Approximations in Stochastic Programming

Cluster: Stochastic Programming

Sponsor: Optimization Section

Sponsored Session

Chair: Chanaka Edirisinghe, University of Tennessee, MS Program, 610 SMC, Knoxville, TN 37996, chanaka@utk.edu

1) Second-Order Lower Bounds on the Expectation of a Convex Function, Steftcho Dokov, University of Texas, Grad. Program in OR, Austin, TX 78712, steftcho@mail.utexas.edu, *David P. Morton*

We develop a class of lower bounds on the expectation of a convex function. The bounds utilize the first 2 moments of the underlying random variable, whose support is contained in a finite interval. We describe extensions for convex functions of random vectors. Our bounds have applications to stochastic programs whose random parameters are known only through limited moment information...

2) Improved Second Moment Bounds in Stochastic Programming, Chanaka Edirisinghe, University of Tennessee, MS Program, 610 SMC, Knoxville, TN 37996, chanaka@utk.edu

New and tighter bounds are developed on the expectation of the recourse function in stochastic programming, using second-order moment information. These bounds are stronger than those developed by Edirisinghe (1996). Relation to generalized moment problems will also be pursued. These bounds are applicable for random vectors with correlated components and compact domains. Computation of the bounds involve only discrete approximating distributions.

3) A Sampling-Based Cutting Plane Method for Stochastic Programs, Javier Salmeron, Naval Postgraduate School, Dept. of OR, Monterey, CA 93943, jsalmeron@nps.navy.mil, *R. Kevin Wood*

For a deterministic convex program, the optimal value of a cutting-plane method's master program provides a lower bound on the original problem's optimal value. We develop a sampling-based cutting-plane method for stochastic programming and characterize the quality of the lower-bound estimator provided by the random master program's solution value.

TC34 Issues in Technology Management

Sponsor: Technology Management Section

Sponsored Session

Chair: Nan Muir Bodensteiner, University of Houston Clear Lake, Box 234, 2700 Bay Area Blvd., Houston, TX 77058, muir@cl.uh.edu

1) Virtual Teams in Business & Education, Nan Muir Bodensteiner, University of Houston Clear Lake, Box 234, 2700 Bay Area Blvd., Houston, TX 77058, muir@cl.uh.edu

Due to the rapidly changing global environment of technology development and the distributed environment of Management of Technology Programs, educational and business organizations are increasingly utilizing virtual teams to address problems and challenges. We will investigate the benefits and barriers plus uncover the challenges of managing a virtual team's tasks and behaviors.

2) Developing an On-Line Master's Degree Program in Management of Technology, William T. Flannery, University of Texas, Mgmt. of Technology Program, 6900 North Loop, 1604 West, San Antonio, TX 78249, wflannery@utsa.edu, *Woodie A. Spivey*

The MS in Management of Technology at UTSA offers "on-line" courses to accommodate students who work full time, are located at remote sites or travel extensively. We discuss the development of an "on-line" program that is totally integrated with the traditional classroom program. The impact on teaching performance evaluations is included.

3) Virtual Teams & the Innovation Process, Glenn Dietrich, University of Texas, 6900 N. Loop 1604 West, San Antonio, TX 78249, gdietrich@utsa.edu

Technology provides the means to share knowledge and to create geographically disbursed collaborative groups to work on common problems. We examine the effect that virtual teams have on the innovation process. The virtual team approach is compared to the more traditional innovation processes. Several case studies are presented.

TC35 Software Demonstration VII

Software Demo Session

Chair: To be announced

1) IBM: IBM/OSL Optimizer, Robert H. Clark, IBM, roclark@us.ibm.com

We will demonstrate the IBM/OSL optimizer and give the latest production announcements. There will be ample time for questions. This presentation is intended for an audience of both academic and commercial participants.

2) **Duxbury Press: StatPro Statistical Add-In**, *Chris Albright*, Indiana University, Kelley Sch. of Bus., Bloomington, IN, albright@indiana.edu

StatPro is a statistical add-in for Microsoft Excel. Its capabilities span from the very basic to the advanced including stepwise regression, logistic regression, and discriminant analysis. SolverTable is an add-in for Excel that greatly simplifies sensitivity analysis and interpretation of spreadsheet models. We will demonstrate these products and answer questions about their use.

Tuesday 14:45-16:15

TD01 Naturalistic Decision Making: An Alternative to Traditional Decision Theory or a Prescription for Disaster?

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Alan J. Brothers, Battelle Pacific Northwest National Laboratory, PO Box 999 K8-03, Richland, WA 99352, alan.brothers@pnl.gov

1) Panel: Naturalistic Decision Making: An Alternative to Traditional Decision Theory or a Prescription for Disaster?, *Lee Roy Beach*, University of Arizona, Coll. of Bus. & Public Admin., Tucson, AZ 85721, *Robert F. Bordley*, General Motors, Renaissance Center, Detroit, MI 48098, robert.bordley@gm.com, *Marvin S. Cohen*, Cognitive Technologies, Inc., *L. Robin Keller*, University of California, Grad. Sch. of Mgmt., 350 GSM, Irvine, CA 92697-3125, lrkeller@uci.edu, <http://www.gsm.uci.edu/~KELLER/>, *Gary S. Klein*, Klein Associates, Inc., *Jim Wise*, Eco*Integrations, Inc.

Naturalistic decision making (NDM) is a new paradigm that studies expert decision making in natural environments. The focus is on rational actors having content expertise making good decisions. The session will introduce NDM along with applications, followed by a panel discussion concerning the pros and cons relative to traditional decision making.

TD02 Multicriteria Decision Making III Contributed Session

Chair: Steven E. Butt, Western Michigan University, Dept. of IME, Kalamazoo, MI 49008, steven.butt@wmich.edu, <http://www.wmich.edu/ime/butt.htm>

1) A Weight Set Partitioning Algorithm for Finding All Efficient Extreme Points in the Outcome Set of a Multiple Objective Linear Program, *Harold P. Benson*, University of Florida, Dept. of DIS, Gainesville, FL 32611, benson@dale.cba.ufl.edu, *Erjiang Sun*

Recently, researchers have suggested for practical and computational reasons, that in multiple objective optimization, efficient points in the outcome set ought to be found rather than efficient points in the decision set. A new method for finding all efficient extreme points in the outcome set of a multiple objective LP is presented. The method is based upon partitioning the weight set in outcome space.

2) Game-Theoretic Selection of a Network Service Provider, *Yupo Chan*, AFIT, 120 Oak Knoll Dr., Dayton, OH 45419, ychan@alum.mit.edu, *Jeffrey Del Vecchio*, *Keith Bruso*

An international telecommunications NSP can be selected with the help of game theory and MCDM. These techniques determine the desirable coalition that a particular NSP should join, considering both monetary results and information security. As a result, the customer and the NSP would embrace the ensuing service provided by the coalition.

3) A Unified Framework for the Multicriteria Evaluation of the Transportation Improvement Projects, *Yizhong Ding*, University of Pittsburgh, Katz Grad. Sch. of Bus., 3424 Ward St., Pittsburgh, PA 15213, yzding@katz.pitt.edu, *Jennifer S. Shang*

We present a comprehensive and flexible evaluation framework for prioritizing transportation improvement projects. The model first identifies and provides an in-depth analysis of evaluation criteria. It then employs AHP to integrate all measures. The proposed method proves to be effective and practical in assessing transportation programs.

4) A Multiobjective Approach to the Assignment of Students to Project Teams, *Steven E. Butt*, Western Michigan University, Dept. of IME, Kalamazoo, MI 49008, steven.butt@wmich.edu, <http://www.wmich.edu/ime/butt.htm>, *Tonya L. Hoye*

We present an MIP model for the assignment of senior engineering students to design project teams. The primary objectives of the model are to maximize student preferences and balance team quality and interest levels. Compared to the previous manual approach, the time necessary to set up the teams is significantly reduced.

TD03 Current Topics in Defense Analysis

Sponsor: Military Applications Society
Sponsored Session

Chair: Cyrus Staniec, Logicon Modeling Simulation & Analysis Center, 2100 Washington Blvd., Arlington, VA 22204, cstaniec@logicon.com

1) Building a Weapon Effects Simulation Federation for Warfighter Support, *Walt Zimmers*, Defense Threat Reduction Agency, 6801 Telegraph Rd., Alexandria, VA 22310, walt.zimmers@dtra.mil

More and more, operational commanders require fast turn-around, high accuracy assessments of weapon effects on targets and consequence assessment such as downwind hazard prediction. The Defense Threat Reduction Agency, in cooperation with the Defense Modeling & Simulation Office, is developing model federations to address the need. We describe the applications, object models and objectives of the WE Federation Program.

2) Programming Models for Systems Engineering Support, *Rodger Pudwill*, Logicon Modeling Simulation & Analysis Center, 2100 Washington Blvd., Arlington, VA 22204, rpudwill@logicon.com

Many problems encountered in the defense arena contain a component that is well-modeled as a mathematical program. System design, system-of-systems architectures, threat management and investment analyses are all typical examples. We will review some recent formulations and their applications, and address issues encountered in using such models in the analytic process.

3) Designing an "Optimal" Test Plan: Integrating M&S in T&E, *Cyrus Staniec*, Logicon Modeling Simulation & Analysis Center, 2100 Washington Blvd., Arlington, VA 22204, cstaniec@logicon.com

Optimal test planning requires a "level playing field" between M&S and traditional test methods, a method to drive the selections and a process for updating data after an event. We describe a model based on importance, credibility and information benefit, along with the process to employ it. We address issues of bringing the model to practical application.

TD04 MAS Session Honoring Dr. Seth Bonder Invited Session

Chair: W. Peter Cherry, Vector Research Inc., PO Box 1506, Ann Arbor, MI 48106, cherryw@vrinet.com

1) Military Applications Society Session Honoring Seth Bonder, *W. Peter Cherry*, Vector Research Inc., PO Box 1506, Ann Arbor, MI 48106, cherryw@vrinet.com, *Bruce W. Fowler*

Dr. Peter Cherry will discuss Dr. Seth Bonder's contribution to Military Operations Research. Next, Dr. Bruce Fowler, Chair of the Military Applications Society, will present Dr. Bonder with the Steinhardt Award.

2) Steinhardt Award Lecture: Versatility Planning: An Idea Whose Time has Come - Again, *Seth Bonder*, Vector Research, Inc., PO Box 1506, Ann Arbor, MI 48106, bonder@vrinet.com

In 1975, I created the concept of "versatility planning" in response to planning issues faced by the DoD. The concept has resurfaced a number of times since as the national security environment became more uncertain after the demise of the Soviet Union. I will describe some versatility planning ideas and summarize some applications to provide a sense of the concept and its appropriateness in today's highly uncertain national security environment.

TD05 Tutorial: Machine Scheduling with Availability Constraints

Cluster: Scheduling
Invited Session

Chair: Chung-Yee Lee, Texas A&M University, 238 Zachry Bldg., Dept. of IE, College Station, TX 77843, cylee@acs.tamu.edu

1) Tutorial: Machine Scheduling with Availability Constraints, *Chung-Yee Lee*, Texas A&M University, 238 Zachry Bldg., Dept. of IE, College Station, TX 77843, cylee@acs.tamu.edu

The majority of scheduling literature assumes that the machines are available at all times. This tutorial presents recent results for machine scheduling problems

where machines may not always be available due to maintenance, breakdown or processing jobs that were scheduled in the previous planning horizon.

TD06 New Paradigms in Designing Quality Systems

Cluster: Service Design
Invited Session

Chair: Ashok Kumar, Grand Valley State University, Seidman Sch. of Bus., 301 West Fulton, Grand Rapids, MI 49504-6495, kumara@gvsu.edu

1) **Enhancing Competitive Capabilities through Quality Practices: An Empirical Study using Structural Equation Modeling**, Luis E. Solis, Instituto de Empresa, Op. & Tech. Mgmt. Dept., Maria de Molina 12-5, Madrid, 28006, Spain, luis.solis@ie.edu, http://www.ie.edu/ie_ingles/index.htm

We empirically assess relationships between quality management practices and competitive capabilities. Data from 300 manufacturing companies were used to test the hypothesized relationships using structural equation modeling. Results confirm that quality management practices play a significant role in building and supporting competitive capabilities. However, some relations between internal quality outcomes with competitive capabilities weren't significant.

2) **Advanced Quality Engineering using Genetic Algorithms**, Tapan Bagchi, Indian Institute of Technology, Dept. of IME, Kanpur, 208016, India, bagchi@iitk.ac.in

Taguchi's 2-step QE method has been noted to be effective in systems with additivity as an intrinsic characteristic. When additivity doesn't exist, sophisticated optimization methods must be used to permit robust design of engineering devices. The problem becomes even more complicated when multiple design objectives must be sought and constraints satisfied. We describe a GA-based method newly created to tackle such problems...

3) **Self-Assessment of Quality Systems: An Introspection of the State-of-the-Art & Proposition of a New Model that Works**, Ashok Kumar, Grand Valley State University, Seidman Sch. of Bus., 301 West Fulton, Grand Rapids, MI 49504-6495, kumara@gvsu.edu, Caesar Douglas

We undertake an exhaustive study of the self-assessment models for quality systems. We look at numerous quality award systems, i.e., MBNQA, EQA, AQA, Deming, etc., and a host of other leading works that have appeared in the quality literature on the subject. We then proceed to pick the best parts of the existing systems and create an optimal composite that works in real life.

TD07 Project Management

Contributed Session

Chair: Eunsang Yoon, University of Massachusetts, Dept. of Mktg., Coll. of Mgmt., 1 University Ave., Lowell, MA 01854, eunsang_yoon@uml.edu

1) **Neural Networks Applied in the Due-Date Assignment of the Semiconductor Factory**, Pei C. Chang, Yuan Ze University, IE Dept., 135 Tuan Tung Rd., Chung-Li, 32026, Taiwan, ROC, iepchang@saturn.yzu.edu.tw, Jih C. Hsieh

Production processes in the semiconductor industry are very time consuming and long-winded. Therefore, the due-date assignment of the product is really a difficult task for the salesman to provide to the customer. We use a simulation model to mimic the manufacturing processes of the semiconductor and information related to the shop is collected for flowtime analysis.

2) **A Comparative Morphologic Analysis of Generated Sets of Project Networks**, Luis V. Tavares, CESUR Instituto Superior Tecnico, Av. Rovisco Pais, Lisbon, 1049 001, Portugal, lavt@civil.ist.utl.pt, Salah E. Elmaghraby, Jose A. Ferreira

Several sets of project networks, generated by different authors, were proposed for benchmark purposes. We have designed a new framework to describe each project's network morphology and present a comparative analysis of such sets using this framework. Several conclusions about how bias and representative these sets are will be presented.

3) **OR/MS Techniques & Software in Project Planning & Control: Current Practices & Future Research**, Bruce Pollack-Johnson, Villanova University, Dept. of Math. Sci., 800 Lancaster Ave., Villanova, PA 19085, bruce.pollack-johnson@villanova.edu, Matthew J. Liberatore

From a random survey of 240 PM professionals, we describe current PM software and OR/MS technique usage patterns, as well as suggestions for future research. We describe those work environment factors that determine level of usage. Results suggest future research should include NPV scheduling and consider integration with software.

4) **Information Technology, Interface Management & Innovation Performance**, Eunsang Yoon, University of Massachusetts, Dept. of Mktg., Coll. of Mgmt., 1 University Ave., Lowell, MA 01854, eunsang_yoon@uml.edu

We investigate the impact of modern IT adoption on a firm's interface management and performance in product innovation. We also examine the influence of external environments, e.g., the industry's business trends and competition and internal environments such as the firm's competitive competence and business orientation.

TD08 Markov Decision Processes & Applications

Sponsor: Applied Probability Society

Sponsored Session

Chair: Kevin D. Glazebrook, University of Newcastle Upon Tyne, Dept. of Stats., Newcastle Upon Tyne, NE1 7RU, UK, kevin.glazebrook@newcastle.ac.uk

1) **Critical-Number Policies for Perishable Inventory Systems**, William L. Cooper, University of Minnesota, Dept. of Mech. Eng., 111 Church St. SE, Minneapolis, MN 55455-0111, billcoop@me.umn.edu

We study a perishable inventory system under a fixed-critical-number order policy and derive new families of upper and lower bounds for the long-run number of outdates per unit time. In addition, we describe numerical results that compare critical-number policies and optimal policies.

2) **Approximate Solution of Markov Renewal Programs with Finite Time Horizons**, Karl-Heinz Waldmann, Universitat Karlsruhe, Inst. Wirtschaftstheorie & OR, Kaiserstr. 12, Geb 20.21, Karlsruhe, 76128, Germany, waldmann@wior.uni-karlsruhe.de, Karl Hinderer

We investigate the error committed by using an infinite time horizon Markov renewal program as an approximation of a Markov renewal program with a finite time horizon. The error is shown to decrease exponentially fast with the time horizon. Improved upper and lower bounds are obtained under additional assumptions.

3) **Improved Estimators of Mean Waiting Time & other Parameters in the M/G/1 Queue**, Kevin Burns, University of Georgia, Dept. of MIS, Brooks Hall, Terry Coll. of Bus., Athens, GA 30602-6273, Andrew F. Seila, T. N. Sriram

We show that the substitution estimator of mean waiting time in queues for the stationary M/M/1 queue, which is constructed by substituting sample estimators for the mean interarrival time, the mean service time and the variance of service times in the expression for mean waiting time, has the undesirable properties that the mean doesn't exist and the variance is infinite...

4) **Index-Based Policies for Discounted Multi-Armed Bandits on Parallel Machines**, Kevin D. Glazebrook, University of Newcastle Upon Tyne, Dept. of Stats., Newcastle Upon Tyne, NE1 7RU, UK, kevin.glazebrook@newcastle.ac.uk

We utilize elements of the recent achievable region account of Gittins indexation by Bertsimas & Nino-Mora to design index-based policies for discounted multi-armed bandits on parallel machines. These policies have expected rewards which come within a $O(a)$ quantity of optimality, where $a > 0$ is a discount rate...

TD09 Logistics II

Contributed Session

Chair: David Simchi-Levi, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, levi@iems.nwu.edu, <http://www.iems.nwu.edu/~levi/>

1) **Supply Chain Management of Perishables**, Gary D. Scudder, Vanderbilt University, Owen Grad. Sch. of Mgmt., 401 21st Ave. South, Nashville, TN 37203, gary.scudder@owen.vanderbilt.edu, Joseph D. Blackburn

Much has been written regarding supply chain management of automobiles and electronics, but supply chain management of perishables has received much less attention. We look at the supply chain for fresh produce from planting to consumption and examine possible strategies for better managing products in these supply chains.

2) **A Solution Methodology for the Tactical Fleet Planning Problem in the Car Rental Industry**, Julian E. Pachon, University of Miami, 8846 SW 72nd St., Apt. H352, Miami, FL 33173, jpachon@umsis.miami.edu, <http://www.eng.miami.edu/~jpachon/>, Lefteris Iakovou, Chi-Ming Ip

Car rental companies operate large fleets in many locations throughout the US. Decision-makers need to match the fleet of different types of vehicles to current and forecasted demands in order to maximize their yield, i.e., to increase the

total number of cars rented at the least possible cost...

3) Using Flexible Pricing Strategies to Improve Supply Chain Performance, Julie L. Swann, Northwestern University, IE/MS Dept., 2145 Sheridan Rd., Evanston, IL 60208-3119, j-swann@nwu.edu, <http://www.iems.nwu.edu/~swann>, **Lap Mui Chan, David Simchi-Levi**

Yield management techniques have been successfully applied to a variety of industries, e.g., airlines and rental car agencies, with a focus on those that have perishable inventory. We consider a multi-period single product problem with non-perishable inventory. The objective is to find a product pricing policy and distribution strategy to maximize profit.

4) The Value of Continuous Information Sharing in a Two-Stage Supply Chain with Capacity Constraint, David Simchi-Levi, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, levi@iems.nwu.edu, <http://www.iems.nwu.edu/~levi/>, **Yao Zhao**

We consider a simply supply chain with a single retailer facing iid demand and a single manufacturer with limited production capacity. We analyze the impact of information sharing and production policies on cost and service levels.

TD10 Production & Scheduling I

Contributed Session

Chair: Ed Mooney, Montana State University, MIE Dept., Bozeman, MT 59717-3800, emooney@ie.montana.edu

1) Optimization & Heuristic Approaches to Resident Scheduling in a Large Medical System, Rema Padman, Carnegie Mellon University, Heinz Sch. of PP&M, 5000 Forbes Ave., Pittsburgh, PA 15213, rpadman@cmu.edu, **Michael P. Johnson, Gersande Ringenbach**

Medical residents and interns are required to complete rotations encompassing a variety of medical specialties. It is crucial yet very time-intensive to design a schedule to ensure that physician educational needs and hospital medical needs are both met. An IP model and heuristic approaches to this problem are presented and compared.

2) Manufacturing Delivery Performance for Supply Chain Management, Joongkyu Choi, University of Florida, 390-5 Maguire Village, Gainesville, FL 32603, jchoi@ufl.edu

We study MTO production systems to determine the optimal planned customer lead time while minimizing the expected total costs so as to quote the lead time to customers on the order arrival. We derive the distribution of actual completion times of the process and compare them to the corresponding quoted due dates to compute the total costs.

3) Maximizing Fleet Performance with Optimized Load Scheduling, Ed Mooney, Montana State University, MIE Dept., Bozeman, MT 59717-3800, emooney@ie.montana.edu, **Feng Li, Glen Sattoriva**

Railcar fleets are increasingly stretched to meet delivery schedules while maximizing car utilization. Loading can be subject to multiple resource constraints and must consider car movement and inventory dynamics. We describe a model and solution algorithms for this problem and document preliminary computational results.

TD11 Recent Work in Experimental Design III

Sponsor: Quality, Statistics & Reliability
Sponsored Session

Chair: Bruce A. Ankenman, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208-3119, ankenman@iems.nwu.edu

1) Process Capability & Decision-Making during Auto Body Validation, Gary D. Herrin, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, gdherrin@umich.edu, **Luis Guzman**

The auto body validation process involves the development and evaluation of stamping parts and assembly processes prior to production launch. Previous case studies have shown that the use of process capability indices with small production runs can be misleading. We propose a methodology for objective decision-making and define an approach for the estimation of process capability using real data from different auto makers.

2) An Expert System to Support Statistics & Optimization Applications in Welding Process Design, Waraporn Ittiwattana, The Edison Welding Institute, 1250 Arthur E. Adams Dr., Columbus, OH 43221, mai_ittiwattana@ewi.org, **Theodore T. Allen**

We present an expert system that we developed in order to support efficient

deployment of response surface optimization and robust engineering in arc welding parameter decision making. We also discuss related statistical challenges and advances including generalizations of low cost response surface methods in the context of automotive applications.

3) Optimal Tolerance Design of RF Circuits, James Brady, Lucent Technologies Inc., 6200 East Broad, Columbus, OH 43213, jbrady@lucent.com, **Theodore T. Allen**

In RF circuit design, nominal component values and their variation have a tremendous effect on production costs. The optimization of the component selection is therefore a stochastic optimization problem. We explain the several roles of statistical techniques in circuit design and illustrate them with a real application.

TD12 Generalized Network Flow Problems

Cluster: Networks

Sponsor: Optimization Section

Sponsored Session

Chair: Dorit S. Hochbaum, University of California, Haas Sch. of Bus., Dept. of IEOR, Etchverry Hall, Berkeley, CA 94720-1777, hochbaum@ieor.berkeley.edu

1) A Combinatorial, Strongly Polynomial Time Algorithm for Minimizing Submodular Functions, Lisa Fleischer, Columbia University, Dept. of IE/OR, 331 Mudd Hall, New York, NY 10027, lisa@ieor.columbia.edu, **Satoru Iwata, Satoru Fujishige**

We present the first combinatorial, strongly polynomial time algorithm for submodular function minimization, answering an open question posed by Grotschel, Lovasz & Schrijver (1981). A new technique of the algorithms is to relax the submodular function by a scaling parameter times the boundary of a flow in a complete directed graph...

2) Solving the Convex Cost Integer Dual Network Flow Problem, Ravindra K. Ahuja, University of Florida, Dept. of ISE, 303 Weil Hall, Gainesville, FL 32611, ahuja@ufl.edu, **Dorit S. Hochbaum, James B. Orlin**

We consider a convex optimization problem where the objective function is the sum of separable convex functions and the constraints are similar to those arising in the dual of a minimum cost flow problem. Using Lagrangian techniques, we can solve this in $O(nm \log(n^2/m) \log(nU))$ time where n and m denote the number of nodes and arcs in the network...

3) A Cut-Based Algorithm for the Convex Dual of the Minimum Cost Network Flow Problem, Dorit S. Hochbaum, University of California, Haas Sch. of Bus., Dept. of IEOR, Etchverry Hall, Berkeley, CA 94720-1777, hochbaum@ieor.berkeley.edu, **Ravindra K. Ahuja, James B. Orlin**

We show how to reduce the convex dual of the minimum cost network flow problem to a polynomial number of minimum s,t-cut problems. This results in the fastest weakly polynomial algorithm known for the minimum cost network flow problem that has a very simple description.

TD13 Dynamic Programming

Contributed Session

Chair: Chelliah Sriskandarajah, University of Texas at Dallas, Sch. of Mgmt., Box 830688, MS JO4.7, Richardson, TX 75083-0688, chelliah@utdallas.edu

1) Optimal Production Control with Periodic Maintenance, Sheldon Lou, California State University, Coll. of Bus. Admin., San Marcos, CA 92096-0001, lou@mailhost1.csusm.edu, **Konstantin Kogan**

We consider a manufacturing system made up of 1 workstation which is able to concurrently produce a number of product-types with controllable production rates in response to a constant demand. The system is periodically stopped for maintenance. Given an infinite planning horizon, the objective is to minimize inventory storage and backlog costs...

2) An Algorithm for Minimizing the Weighted Earliness Penalty in the Single Machine Problem, Supachai Pathumnakul, Iowa State University, Dept. of IMSE, 2019 Black Engineering, Ames, IA 50011-2164, spathumn@iastate.edu, **Pius J. Egbelu**

The problem of minimizing the weighted earliness penalty in a single machine is addressed. A heuristic algorithm is developed to solve the problem. Sample problems are solved and the solutions obtained from the heuristic are found to compare very favorably to optimal solutions obtained from mathematical models.

3) On-Line Scheduling to Minimize Weighted Completion Times, Edward J. Anderson, University of New South Wales, Australian

Grad. Sch. of Mgmt., Sydney, NSW, 2052, Australia, eddiea@agsm.edu.au, **Chris Potts**

We show that a simple modification of the shortest weighted processing time rule achieves a performance guarantee of 2 when used as an on-line heuristic to minimize a weighted sum of completion times on one machine.

4) Optimality Criteria for Deterministic Infinite Horizon Optimization, Irwin E. Schochetman, Oakland University, Dept. of Math. & Stats, Rochester, MI 48309, schochet@oakland.edu, **Robert L. Smith**

We consider the problem of selecting an optimality criterion for a very general deterministic infinite horizon optimization problem over discrete time. Our focus is on average optimality and efficiency (a.k.a. finite optimality). We give sufficient conditions for efficient solutions to exist and be average optimal.

5) Scheduling Dual Gripper Robotic Cells for Gaining Productivity, Chelliah Sriskandarajah, University of Texas at Dallas, Sch. of Mgmt., Box 830688, MS JO4.7, Richardson, TX 75083-0688, chelliah@utdallas.edu, **Jeffrey B. Sidney, Suresh P. Sethi**

Dual gripper robots are potentially more productive than single gripper robots in cellular manufacturing but very few analytical results are available on dual gripper performance. We present results on the performance of dual gripper robots operating in a bufferless environment and provide comparisons with single gripper performance.

TD14 Fractional Programming & Generalized Convexity

Cluster: Nonlinear Programming

Sponsor: Optimization Section

Sponsored Session

Chair: Siegfried Schaible, University of California, Anderson Grad. School of Mgmt., Riverside, CA 92521, siegfried.schaible@ucr.edu

1) 0-1 Hyperbolic Programming, Mohit Tawarmalani, University of Illinois, Dept. of Chemical Eng. & MIE, 600 South Mathews Ave., Urbana, IL 61801, tawarmal@alexander.scs.uiuc.edu, **Shabbir Ahmed, Nick Sahinidis**

We develop and apply the theory of convex extensions to reformulate 0-1 hyperbolic programs into MILPs. We compare the tightness of the resulting relaxations and provide computational experience with our implementation. We discuss applications in facility location and in modeling stochastic programs with decision-dependent uncertainties.

2) Duality for Linear Multiplicative Programs, Carlton H. Scott, University of California, Grad. Sch. of Mgmt., Irvine, CA 92697, chscott@uci.edu, **Thomas R. Jefferson**

Multiplicative programs are an important class of nonconvex optimization problems that are currently the subject of considerable research. We derive duality results for linear multiplicative programs, both in the general nonconvex and in the convex case. Concepts from conjugate function theory and signomial programming are used.

3) Duality for DC Optimization over Compact Sets, Juan-Enrique Martínez-Legaz, Universitat Autònoma de Barcelona, CODE, Dept. D'Economia & Hist. Econ., Bellaterra, 08193, Spain, juanenrique.martinez@uab.es, **Michel Volle**

For DC inequality constrained optimization problems over compact convex sets, we define a dual problem and get a strong duality theorem without any constraint qualification. Applications include the minimization of a DC function on a (not necessarily convex) compact set and the general LP problem with binary variables.

4) Positive Sub-Definite Matrices, Generalized Monotonicity & Linear Complementarity Problems, Jean-Pierre Crouzeix, Université Blaise Pascal, CUST, 24 Ave. des Landais, Aubiere Cedex, 63174, France, crouzeix@ucfma.univ-bpclermont.fr, **Abdelhak Hassouni, Amale Lahlou, Siegfried Schaible**

Positive sub-definite matrices were introduced by Martos to characterize generalized convex quadratic functions. This concept is extended to nonsymmetric matrices. It leads to a study of pseudomonotone matrices and to new characterizations of generalized monotone affine maps. Finally, some properties of linear complementarity problems involving such maps are derived.

TD15 Optimization Techniques II

Contributed Session

Chair: John W. Chinneck, Carleton University, Systems & Computer Eng., 1125 Colonel By Dr., Ottawa, Ontario, K1S 5B6, Canada, chinneck@sce.carleton.ca, www.sce.carleton.ca/faculty/chinneck.html

1) A General Purpose Simulated Annealing Algorithm for Integer Linear Programming, Seksan Kiatsupaibul, University of Michigan, Dept. of IOE, 2170 Cram Pl., #14, Ann Arbor, MI 48105, centered@engin.umich.edu, **Robert L. Smith**

We propose a Markov chain sampling algorithm to generate points uniformly distributed on an arbitrary bounded region of a high dimensional integer lattice. We use this to construct a general purpose SA algorithm for integer LPs that converges to the global optimum with probability one.

2) Computational Testing on a Modified Descent Method, Li-Wen Chen, National Cheng Kung University, Dept. of Civil Eng., 1 Da-Shua Rd., Tainan, 701, Taiwan, idofmy.bbs@bbs.civil.ncku.edu.tw, **Yusin Lee**

The simple descent method get trapped at the first local minimum encountered and it is commonly believed that the performance will not come close to those by more elaborate heuristics. Computational testing shows that a slightly modified version of the descent method can yield results comparable to TS and SA.

3) Generation Techniques for Strong Covering Units of One-Dimensional Tilings, Connie G. Fournelle, University of Kentucky, 715 Patterson Office Tower, Lexington, KY 40506-0027, connieg@ms.uky.edu, **Carl W. Lee**

A strong covering unit of a tiling J is a cluster of tiles which can cover any subfacet star appearing in J . We give techniques for generating strong covering units for one-dimensional aperiodic tilings based on examination of the window used to construct the tiling under the projection method.

4) Layout of Two-Dimensional Irregular Shapes using Heuristics, Rym M'Hallah, Institut Supérieur de Gestion Sousse, BP 763, Sousse, 4000, Tunisia, rym.mhallah@irsit.rnrt.tn, **Ahlem Bouziri**

We present a new heuristic for the layout of irregular 2-dimensional shapes used in the garment industry. The heuristic is very simple and exceptionally fast. Its application to real cases from the garment industry has yielded good results, comparable to those obtained by human markers.

5) MProbe: What's in your Mathematical Program?, John W. Chinneck, Carleton University, Systems & Computer Eng., 1125 Colonel By Dr., Ottawa, Ontario, K1S 5B6, Canada, chinneck@sce.carleton.ca, www.sce.carleton.ca/faculty/chinneck.html

Sometimes you need to know more about your mathematical program than solvers will tell you. What are the shapes of the nonlinear functions and constrained region? How effective are the constraints? Which constraints are redundant. A general analysis tool such as MProbe can answer questions such as these. See <http://www.sce.carleton.ca/faculty/chinneck/mprobe.html>.

TD16 Airport Performance Predictors & Enhancements

Sponsor: Transportation Science Section

Sponsored Session

Chair: Sarah Stock Patterson, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, sarah.sp@duke.edu

1) Estimating Airport Arrival Capacity Distributions, Tasha R. Inniss, University of Maryland, Applied Math Program, Inst. for Systems Research, College Park, MD 20743, tri@math.umd.edu, **Michael O. Ball**

Incident weather reduces an airport's arrival capacity, which results in the institution of a ground delay program (GDP). We present statistical models for estimating capacity scenario distributions based on historical data from the airport. These distributions are required inputs to stochastic models for optimizing GDP parameters.

2) Predicting Taxi-Out Time Distributions, John-Paul Clarke, MIT, 77 Massachusetts Ave., Rm. 33-407, Cambridge, MA 02139-4307, **Laura Kang**

Knowledge of the expected duration between pushback from the gate at the origin airport and touchdown on the runway at the destination airport are critical inputs to the ground delay program (GDP) used by the FAA to manage the arrival flow into airport with limited capacity...

3) An Intermodal Systems Approach to Model Air Traffic Leakage in a Multiple-Airport Region, Peter Chen, University of Illinois, Dept. of Civil & Environ. Eng., 1213 Newmark Civil Eng.

Lab., Urbana, IL 61801, pschen@uiuc.edu, *Gozen Basar*

Airports experience traffic leakage to other neighboring airports or other modes of transportation due to either capacity constraints or (actual or perceived) low level of service provided. We present an air traffic leakage model using an intermodal systems approach and discuss results from a case study for the Central Illinois region.

4) Impact of Collaborative Ground Delay Programs in Air Traffic Control, John Jensen, MIT, 270 Huron Ave., Cambridge, MA 02138, jjensen@alum.mit.edu

The US Air Traffic Control system is in the midst of a revolutionary change where many future decisions will be made in a collaborative process between the FAA and the airlines. We will discuss results from the first 2 years of collaborative decision making on GDP slot utilization, ground delays, airborne holding delays and enroute flight times.

TD17 Optimization Problems in Stochastic & Dynamic Transportation Networks

Sponsor: Transportation Science Section

Sponsored Session

Chair: Elise D. Miller-Hooks, Pennsylvania State University, Dept. of Civil & Environ. Eng., 212 Sackett Bldg., University Park, PA 16802, edm3@psu.edu

1) Time-Dependent Data Representations & Dynamic Network Algorithms, Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu, Vinay Yappadanavar

We give methods for representation of time-dependent data. These representations lead to different algorithms for a given dynamic network problem. We illustrate this by developing efficient algorithms and computer implementations to solve dynamic shortest path problems. Computational results are given.

2) Optimization of Stochastic Dynamic Transportation Systems, S. Travis Waller, Northwestern University, Dept. of Civ. Eng., 2145 Sheridan Rd., Tech. Inst., Evanston, IL 60208, travis@trans.civil.nwu.edu, Athanasios Ziliaskopoulos

Techniques for developing robust solutions to transportation optimization problems will be presented when the origin-destination demand is taken as uncertain. Multiple transportation decisions will be formulated within a multi-stage model where strategic decisions are made while accounting for the fact that later decisions can be taken as recourse.

3) Algorithms for Shortest Path Problems in Stochastic Time-Dependent Networks, Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu, Seong-Cheol Kang

We consider shortest path problems in stochastic time-dependent networks. We present solution algorithms with optimal run times. The computational efficiency of these algorithms is demonstrated theoretically as well as experimentally.

4) Robust Real-Time Routing, Elise D. Miller-Hooks, Pennsylvania State University, Dept. of Civil & Environ. Eng., 212 Sackett Bldg., University Park, PA 16802, edm3@psu.edu, Baiyu Yang

We present an overview of the RTR algorithm for determining robust least expected time paths under real-time information. Taking into account the inherent probabilistic and dynamic characteristics of future travel conditions, the benefits of employing the RTR algorithm over using deterministic (static/dynamic) routing procedures and the value of spatial and temporal information are investigated.

TD18 Some Mindles for Management Science

Sponsor: INFORM-ED

Sponsored Session

Chair: Sam L. Savage, Stanford University, Dept. of MSE, 417 Terman Eng. Ctr., Stanford, CA 94305-4023, savage@stanford.edu

1) Some Mindles for Management Science, Sam L. Savage, Stanford University, Dept. of MSE, 417 Terman Eng. Ctr., Stanford, CA 94305-4023, savage@stanford.edu

Just as appropriately designed handles make things easier to grasp with our hands, devices that make things easier to grasp with our minds should be called "mindles." Several mindles for MS will be presented including blitzograms, distribution-distribution and the law of averages.

TD19 OR/MS in Forestry IV

Cluster: Forestry

Sponsor: ENRE

Sponsored Session

Chair: Robert G. Haight, USDA Forest Service, North Central Res. Station, 1992 Folwell Ave., St. Paul, MN 55108, rhaight/nc@fs.fed.us

1) Approaches for Solving the Area Restriction Model in Harvest Scheduling, Alan T. Murray, Ohio State University, Dept. of Geography, 1036 Derby Hall, Columbus, OH 43210-1361, murray.308@osu.edu, amurray@geography.ohio-state.edu, Andres Weintraub

Area-based restrictions in harvest scheduling have characteristically been addressed in forest planning models by preliminary processing and analysis. This is understandable given the inherent difficulty associated with identifying areas a priori in order to specify explicit spatial restrictions in an optimization model. Alternative ways for representing area restrictions continue to be pursued...

2) Modeling Habitat Connectivity in Spatially Explicit Forest Management Planning Models, Marc McDill, Pennsylvania State University, 214B Ferguson Bldg., Sch. of Forest Resources, University Park, PA 16802-4301, mem14@psu.edu, Janis Braze

A modern bioreserve strategy typically includes fixed bioreserve areas and corridors which provide for migration of plants and animals between bioreserve areas. A spatially-explicit forest planning formulation is presented that can be used to optimize the design of corridors between bioreserves and that allows corridors to move.

3) Generation of Optimal Transportation Corridors through Wetlands, Joseph P. Roise, North Carolina State University, Dept. of Forestry, Box 8008, Raleigh, NC 27695-8008, joe_roise@ncsu.edu, Joseph V. Bianco

A method of determining optimal transportation corridor paths through areas containing wetlands is presented. The method uses GIS, a multiple criteria cost model and the North Carolina Coastal Region Evaluation of Wetland Significance program. The minimum cost model is the weighted sum of constructions costs and impact on wetland habitat, hydrology and water quality.

4) Optimizing Helicopter Yarding Operations, John Sessions, Oregon State University, Coll. of Forestry, Corvallis, OR 97331, john@sessions.cof.orst.edu, Woodam Chung

A spatial computer model is being developed to assist in the strategic and tactical planning of helicopter logging operations. It operates in 2 phases: it first searches among alternative paths between log pickup points and landings to identify the shortest flight time; it then searches for the combination of roads and landings that minimize total construction plus yarding costs...

5) Development of a Hybrid Tabu Search & GA Procedure to Solve Spatial Harvest Scheduling Problems Encountered by the Forest Industry, Kevin Boston, University of Georgia, Warren Sch. of Forest Resource, Athens, GA 30602, kboston@smokey.forestry.uga.edu, Peter Bettinger

Most forestry firms in the US have adopted the AFPA sustainable forest initiative that includes a green-up constraint. An additional goal is the development and maintenance of minimum-sized blocks of wildlife habitat. To solve these problems, a heuristic technique was developed that combines TS and GAs.

TD20 Queuing Models of Spares Provisioning Systems

Cluster: Math Modeling/Stat Inference/Comp Methods in Queuing System
Invited Session

Chair: Muhammad A. El-Taha

1) A Two-Echelon Service Parts Inventory System with Compound Poisson Customer Arrivals: Performance Evaluations, Yunzeng Wang, Case Western Reserve University, Dept. of OR & Op. Mgmt., WSOM, 10900 Euclid Ave., Cleveland, OH 44106-7235, yxw36@po.cwru.edu

Consider a 2-echelon inventory system with a central depot and N distribution centers. Customers arrive at the distribution centers according to compound Poisson processes. Under the assumptions of 1-for-1 policy and i.i.d. depot replenishment lead times, we derive exact system performance evaluations.

2) A Reliability & Spare Parts Allocation Model, Daoud Ait-Kadi, Universite Laval, Dept. of Mech. Eng., Pavillon Pouliot, Ste. Foy, Quebec, G1K 7P4, Canada, daoud.ait-kadi@gmc.ulaval.ca

We address the problem of reliability and spare parts allocation for a system

consisting of N components. The failure of any component induces the failure of the system. The formulation of this problem leads to a mixed NLP model. An efficient algorithm was developed to solve some instances of this design optimization problem.

3) The Service-Constrained Spares Provisioning Problem with Two Types of Failures, *Muhammad A. El-Taha, Nadim Abboud*

A set of machines is deployed to meet a constant demand. While operating, a machine fails due to a failure of one of 2 parts. A failed machine is sent for repairs after a new part arrives. We determine the number of machines and repair channels needed to minimize overall costs and meet a service level constraint.

TD21 Industrial Applications II

Contributed Session

Chair: Ali Elkamel, University of Kuwait, Dept. of Chemical Eng., PO Box 5969, Safat, 13060, Kuwait, elkamel@kuc01.kuniv.edu.kw

1) Prediction of Product Yields & Properties of Refinery Heavy Distillate Processes, *Khaled Al-Hajri*, Kuwait University, Dept. of Chemical Eng., PO Box 5969, Safat, 13060, Kuwait, alhajri@hotmail.com, *Ali Elkamel, Nadia Al-Khabbaz*

The mechanisms of petroleum refining processes are too complex and no thorough model has been developed. Neural networks represent an effective alternative to mathematical modeling of refinery operations if sufficient amount of input-output data is available. Feed-forward neural networks that model some important commercially established petroleum refining distillate processes are presented.

2) A Vehicle Routing Problem with Time Constraints & Variable Rewards: An Application in the American Red Cross, *Jinxin Yi*, Carnegie Mellon University, GSIA, 4909 Center Ave., Apt. 17, Pittsburgh, PA 15213, jyi@andrew.cmu.edu, *Alan Scheller-Wolf*

We describe a VRPTW faced by the American Red Cross related to decomposing blood into platelets. Due to perishability, the problem has time dependent rewards that make the standard solution methods inapplicable. By exploiting problem structure, we develop an algorithm which can solve a 100-site problem in 5 minutes.

3) Profit Maximization vs. Percentile Waste Minimization in the Paper Cutting Stock Problem, *Vinicius F. Arcaro*, State University of Campinas, Praca Toledo Barros 258, Limeira, Sao Paulo, 13480-008, Brazil, vfa@widesoft.com.br

This study improves the overall characteristics of the solutions given by the Gilmore & Gomory cutting stock model. Changes are proposed for the constraints as well as for the objective function. The major point is that profit maximization, rather than percentile waste minimization, is the goal that should be pursued.

4) A Plant Selection Market Allocation Model, *Vijay Gupta*, Warner Lambert Co., 201 Tabor Rd., Bldg. 86-1, Morris Plains, NJ 07950, vijay.gupta@wl.com, *Emmanuel Peters, Kelvin Blyden*

A model that represents real world multi-plant location and investment decisions is formulated. The decisions included are plant openings and closing, reassigning technologies among plants and optimizing labor capacities. The costs considered are manufacturing, transportation, duties, moving, etc. Our proposed model helps achieve optimal

5) Combining Artificial Neural Networks & Scaling to Solve Partial Differential Equations: Applications to Flow Problems in Reservoirs, *Ibrahim Hindi Al-Hajri*, Kuwait University, Dept. of Chemical Eng., PO Box 5969, Safat, 13060, Kuwait, ibrahim@hotmail.com, *Ali Elkamel*

The transient modeling of processes leads to ordinary and partial differential equations. To calculate quantities of interest for these processes, i.e., efficiencies and limiting values, these equations must be solved. For most practical processes, a numerical solution is often required. In the case of fluid flow problems in porous media, reservoir simulators are often used...

TD22 Knowledge & Technology II

Cluster: Knowledge & Technology
Invited Session

Chair: Mari Buche, University of Kansas

1) Project Management Knowledge Networks, *Steve Neuendorf*, Corporate Consulting Group

A PMKN is a major opportunity to test, develop and improve the effectiveness of the ways in which an organization manages projects! A PMKN is a group of

cross-industry or industry-specific organizations that have come together to form a special community of shared knowledge, learning and growth. PMKNs exist to give organizations an unparalleled opportunity to improve their project performance...

2) Capturing Process Knowledge with Belief Functions, *H. James Nelson*, University of Utah

Business processes are complex and difficult to measure. While many ad hoc forms of business process modeling exist, none are based in formal modeling theory. We present a theory-based methodology for modeling business processes and demonstrate how belief functions can measure diverse aspects of business processes.

3) Reusing Knowledge Artifacts in IT Projects, *Karin Darais*, University of Utah

We describe the benefits of reusing software artifacts other than code. The results are taken from a study of an SEI/CMM Level 3 organization that maintains a process asset library and utilizes a structured methodology, thereby capturing business domain knowledge in software process documents. Tips are given for reusing artifacts in an e-business environment.

4) Knowledge Interference: Overcoming Barriers to IT Paradigm Shifts, *Deb Armstrong*, University of Utah

The field of IS is constantly facing paradigm shifts. A major paradigm shift is currently taking place from procedural to object-oriented computer programming techniques (Vessey & Conger, 1994; Pei & Cutone, 1995; Eaton & Gatian, 1996). A problem facing IS organizations during this paradigm shift is a severe shortage of programmers available to put these object-oriented techniques into practice (Page-Jones, 1994; Eaton & Gatian, 1996)...

TD23 Modeling Uncertainty in Electric Power Markets

Cluster: Energy

Sponsor: ENRE

Sponsored Session

Chair: Nicola Secomandi, PROS Strategic Solutions, 3223 Smith St., Ste. 100, Houston, TX 77006, nsecomandi@prosweb.com

1) A Stochastic Fundamental Model of Electricity Prices, *James E. Smith*, Duke University, Fuqua Sch. of Bus., Box 90120, Durham, NC 27708-0120, jes9@mail.duke.edu, *Graydon L. Barz*

We describe a fundamental approach to the modeling of electricity prices that explicitly models the stochastic process of demand and the stochastic dynamics of the supply curve. We discuss the estimation of the model and its use in valuing contracts and assets whose value are derived from electricity prices.

2) A Stochastic Model for Price-Based Unit Commitment & its Application to Generation Asset Valuation, *Chung-Li Tseng*

The unit commitment problem is modeled as a multi-stage stochastic programming problem under price and load uncertainties, represented by a scenario-tree. At each time period, the operator needs to schedule units so as to maximize expected profit while meeting demand. A unit decommitment method is developed to solve this problem.

3) Incentive Regulation of Must-Run Generation, *Alfredo Garcia*

Given the physical constraints of power flow, must-run generation is a pervasive feature of electricity markets. When its pricing is embedded into the spot market, a substantial degree of market power can be exercised and it is usually evidenced through great variability of intraday bids. We propose a pricing rule that provides incentives for truthful cost revelation...

TD24 Supply Chain Issues for Reuse

Cluster: Green Manufacturing

Invited Session

Chair: Canan R. Savaskan, INSEAD, Technology Mgmt. Dept., Blvd. de Constance, Fontainebleau, 77300, France, rezzan.canan.savaskan@insead.fr

1) Shared-Savings Contracts in a Supply Chain, *Charles J. Corbett*, UCLA, AGSM, 110 Westwood Plaza, Box 951481, Los Angeles, CA 90095-1481, charles.corbett@anderson.ucla.edu, *Gregory A. DeCroix*

We study the impact of shared-savings contracts on efforts to reduce consumption in a simple supply chain consisting of one supplier and one customer. In particular, we characterize the equilibrium effort levels and compare effort, each player's profit and total channel profits among different contracts.

2) Management of Product Take-Back Systems with Multiple Retail Outlets, *Canan R. Savaskan*, INSEAD, Technology Mgmt.

Dept., Blvd. de Constance, Fontainebleau, 77300, France, rezzan.canan.savaskan@insead.fr, **Luk N. van Wassenhove**

We model the implications of retail competition on the reverse channel choice and channel profits by modeling: the reverse channel where products are taken directly by the manufacturer and the channel structure where retailers take responsibility for product take-back. Secondly, we show that when managed properly, product take-back systems are self-coordinating even when retailers face different demand structures.

3) Assessing the Economic Attractiveness of Reuse, V. Daniel R. Guide, Jr., Duquesne University, Palumbo Sch. of Bus. Admin., 600 Forbes Ave., Pittsburgh, PA 15282, guide@duq.edu, **Luk N. van Wassenhove**

We develop an economic framework that may be used to assess the economic attractiveness of reuse activities. We also show how the framework may be used to optimize operational decisions if reuse activities are economically viable.

TD25 Mediating & Monitoring Business-to-Business E-Commerce

Cluster: Business-to-Business E-Commerce
Invited Session

Chair: Mareike Schoop, RWTH Aachen, Informatik V, Ahornstr. 55, Aachen, 52056, Germany, schoop@informatik.rwth-aachen.de

1) Business Negotiation Support: Theory & Practice, Aldo de Moor, Tilburg University, Infolab, Fac. of Economics, PO Box 90153, Tilburg, 5000 LE, The Netherlands, ademoor@kub.nl, **Frank Dignum**, Mareike Schoop, Hans Weigand

A negotiation process consists of several distinct stages with their own characteristics. To provide adequate support for these stages, a set of tools needs to be available. We overview existing negotiation support approaches and tools and propose directions for the construction of a formal theory of business negotiation. The ideas are illustrated with examples from the MEMO project.

2) A Repository-Based Approach for Business Data Management in Business-to-Business Electronic Commerce, Christoph Quix, RWTH Aachen, Informatik V, Ahornstr. 55, Aachen, 52056, Germany, quix@informatik.rwth-aachen.de, **Mareike Schoop, Matthias Jarke**

In B2B e-commerce, a broker system is used to mediate and monitor the transactions between different partners. A repository system forms the memory of this broker which stores company and product profiles and contract clauses. We propose a federated repository architecture that uses sophisticated meta-data management facilities to adapt the memory of the broker to the needs of the clients.

3) DocLog: A Semantics-Oriented Language for the Exchange of Contractual Terms, Yao-Hua Tan, Erasmus University Rotterdam, Ctr. for E-Commerce, Rotterdam, The Netherlands, ytan@fac.fbk.eur.nl, **Walter Thoen**

The Internet is revolutionizing communication between organizations. Several initiatives aim to develop new communication standards that exploit the Internet's capabilities. Most initiatives share a data perspective on communication. We argue that this data perspective is not optimal for negotiating contracts. As an alternative, we present a semantic perspective on communication.

TD26 Strategic Use of Logistics

Sponsor: Section on Logistics
Sponsored Session

Chair: Paul Larson, University of Nevada, Managerial Sci. Dept., Reno, NV 89557, plarson@unr.edu

1) "Grocer-E" & E-Commerce Fulfillment, Ronald S. Tibben-Lembke, University of Nevada, Managerial Sci. Dept., MS 028, Reno, NV 89557, rtl@unr.edu

Despite initial claims to the contrary, "bricks and mortar" are extremely important to e-commerce operations. We discuss some of the unique challenges presented in designing a distribution network for e-commerce fulfillment, looking at several firms, in particular at "Grocer-E" and small-items e-tailers.

2) No Title Supplied, Paul Larson, University of Nevada, Managerial Sci. Dept., Reno, NV 89557, plarson@unr.edu

No abstract supplied.

3) The Strategic Role of Logistics in Agribusiness: The Case of New Zealand Dairy, Jay K. Sankaran, University of Auckland, MSIS Dept., Private Bag 92019, Auckland, New Zealand, j.

sankaran@auckland.ac.nz, **Patrick M. Luxton**

We examine the historical relation of logistics to a strategy of cost leadership in the New Zealand dairy industry. We especially dwell on the influence of the structure, e.g., operating mechanisms, of the New Zealand dairy industry. We also address the extension of our analysis to other agribusiness industries.

4) Selected Best Practices in Global Supply Chain Operations, Richard Dawe, Fritz Institute of Global Logistics/Golden Gate University, rick.dawe@fritz.com

The Fritz Institute has studied best practices in global operations management since 1994. We measure the value added by leading best practices such as make-to-order, vendor managed inventory, merge-in-transit and Web-based collaborative planning, forecasting and planning. Developments in best practices, systems and organization of contract service providers are discussed.

TD27 Finance & Risk Management II

Contributed Session

Chair: Helmut E. Mausser, Algorithmics, Inc., 185 Spadina Ave., Toronto, Ontario, M5T 2C6, Canada, hmausser@algorithmics.com

1) Value Management, Klaus Hellwig, University of Ulm, Helmholtzstr. 18, Ulm, 89069, Germany, hellwig@mathematik.uni-ulm.de

The value of consumption vector c is defined as the present value of c discounted with prices that support c . We consider situations where c is required to depend upon its value and its supporting prices. It is shown that such a c can be derived from a (generally nonconvex) NLP.

2) Real Option Valuation & Simulation, Gonzalo Cortazar, Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago ZZ, Chile, gcortaza@ing.puc.cl

An overview of alternative numerical methods for solving real option problems is discussed. The extension of simulation methods to American-type options is discussed and a solution to Brennan & Schwartz's 1985 classic mine valuation problem is presented.

3) Mean-Variance Portfolio Selection with Random Coefficients, Xunyu Zhou, Chinese University of Hong Kong, Dept. of SE & EM, Rm. 116, Ho Sin Hang Eng. Bldg., Hong Kong, Shatin NT, PR China, xyzhou@se.cuhk.edu.hk, **Andrew Lim**

We are concerned with a continuous-time mean-variance portfolio selection model with random coefficients. The problem is formulated as a stochastic linear-quadratic control problem with constraints. The corresponding Riccati equation is solved as a backward stochastic differential equation. This gives rise to the efficient frontier in a closed form for the original portfolio selection problem.

4) Scenario-Based Risk Management, Helmut E. Mausser, Algorithmics, Inc., 185 Spadina Ave., Toronto, Ontario, M5T 2C6, Canada, hmausser@algorithmics.com, **Dan Rosen**

Scenario-based techniques offer many advantages over analytical approaches when dealing with market and credit risk. We present several risk management tools that are consistent with this framework, ranging from value-at-risk analysis to optimization models for various risk measures.

TD28 Applications of Integer Programming

Cluster: Computational Mixed Integer Programming
Invited Session

Chair: Wilbert E. Wilhelm, Texas A&M University, Dept. of IE, College Station, TX 77843-3131, wilhelm@tamu.edu

1) A Parallel Branching Scheme for MIP Instances from Brain Tumor Radiosurgery Planning, Eva K. Lee, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, eva.lee@isye.gatech.edu

2) A Branch & Price Approach to Upgrading High-Tech Products: Computational Experience, Purushothaman Damodaran, Texas A&M University, Dept. of IE, College Station, TX 77843-3131, purush@tamu.edu, **Wilbert E. Wilhelm**

3) Tighter Reformulations for the Asymmetric Traveling Salesman Problem with Precedence Constraints, Patrick J. Driscoll, US Military Academy, West Point, NY 10996, ap554@usma2.usma.edu, **Hanif D. Sherali**

TD29 Managing Product Variety III

Cluster: Managing Product Variety
Invited Session

Chair: Joseph Geunes, University of Florida, Dept. of ISE, 303 Weil Hall, PO Box 116595, Gainesville, FL 32611, geunes@ise.ufl.edu

1) Demand Management through Guaranteed Lead-Times in a Make-to-Order Environment, Jayashankar Swaminathan, University of California, Haas Sch. of Bus., Berkeley, CA 94720, mjs@haas.berkeley.edu, **Uday S. Rao, Jun J. Zhang**

We present a model on the interaction between lead-time-based production planning in a make-to-order environment and its impact on customer demands. We assume that the demand is stochastically related to the lead-time quoted and the firm has limited production capacity in every period. The firm can use in-house capacity or outsource at a higher cost...

2) Requirement Planning for Production Systems with Bill-of-Materials Flexibility, Joseph Geunes, University of Florida, Dept. of ISE, 303 Weil Hall, PO Box 116595, Gainesville, FL 32611, geunes@ise.ufl.edu, **Anantaram Balakrishnan**

We address requirements planning for 2-stage manufacturing systems with component substitution options and describe a method to find production and substitution costs while satisfying demands. Computational results provide insights into factors affecting substitution decisions and the value of bill-of-materials flexibility in manufacturing.

3) Product Variety & Consumer Switching, Michael Pangburn, Pennsylvania State University, 303 Beam Bldg., University Park, PA 16802-1913, mikepangburn@psu.edu, **Euthemia Stavroulaki**

Manufacturers designing a range of products must understand how variety choices impact consumers' purchases. Sales volumes are influenced by competition across product selections and the ability of customers to switch between them. The decision problem requires making optimal product selections from a set of candidate product varieties.

TD30 Panel: Reengineering ERP

Sponsor: MSOM

Sponsored Session

Chair: Mark L. Spearman, University of Alabama, Dept. of MS & Stats., Tuscaloosa, AL 35487-0226, harley@isye.gatech.edu

1) Panel: Reengineering ERP, Mark L. Spearman, University of Alabama, Dept. of MS & Stats., Tuscaloosa, AL 35487-0226, harley@isye.gatech.edu, **Ramesh Srinivasan,** IBM, Storage Systems Div., San Jose, CA, sramesh@us.ibm.com, **Rajan Suri,** University of Wisconsin, Dept. of IE, Mech. Eng. Bldg., 1513 University Ave., Madison, WI 53706-1572, suri@engr.wisc.edu, **Scott A. Moses,** University of Oklahoma, Sch. of IE, 202 West Boyd St., 124 Carson Engineering Ctr., Norman, OK 73019

ERP software and consulting has become a multi-billion dollar industry. In spite of this, the latest offerings continue to build upon material requirements planning a la Joseph Orlicky circa 1965, e.g., SAP/R3. Of course, there are add-ons to fix the problem caused by assuming infinite capacity, e.g., fixed lead times that depend only on the part...

TD31 Issues in Supply & Demand Management

Sponsor: MSOM

Sponsored Session

Chair: Rachel Q. Zhang, University of Michigan, Dept. of IOE 2797, 1205 Beal Ave., Ann Arbor, MI 48109-2117, rzhang@umich.edu

1) Quality Uncertainty, Switching Costs & their Effect on Customer Loyalty, Noah F. Gans, University of Pennsylvania, OPIM Dept., The Wharton School, Philadelphia, PA 19104-6366, gans@wharton.upenn.edu

In many services, the presence of switching costs deters dissatisfied customers from defecting to a competitor. We develop a model of consumer decision making that explicitly accounts for these switching costs and show they affect resulting consumer behavior.

2) Supply-Chain Performance of Vendor-Managed Inventory, Michael Fry, University of Michigan, IOE Dept., 1205 Beal Ave., Ann Arbor, MI 48109-2117, mjfry@umich.edu, **Roman Kapuscinski, Tava M. Lennon Olsen**

VMI is a supply-chain agreement that shifts the burden of inventory management to the supplier. We use analytical models to evaluate VMI and examine several contractual issues that occur under such an agreement. In particular, we describe the behavior induced by VMI on the participants and examine supply chain coordination under VMI.

3) Inventory Control with Overtime & Premium Freight, Eric L. Huggins, University of Michigan, 1205 Beal Ave., Ann Arbor, MI 48109-2117, hugginse@umich.edu, **Tava M. Lennon Olsen**

We consider a manufacturer that must fill stochastic demand. When shortages occur, the manufacturer may choose to meet the unmet demand with overtime production and/or by premium freight shipments. We derive optimal production policies for regular and overtime production and discuss the tradeoffs involved.

4) Inventory Control in Systems with Different Product Life-Cycles, Katia C. Frank, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, kfrank@umich.edu, **Rachel Q. Zhang**

We consider a periodic review inventory system with 2 part numbers that are used together. While the lifetime of part 1 is long and assumed infinite, part 2 is discarded after one period. We characterize the optimal structure of the ordering policies for both part numbers.

TD32 OR/AI Techniques in E-Commerce

Sponsor: Computing Society

Sponsored Session

Chair: Jan Stallaert, University of Texas, Dept. of MS/IS, CBA 5.202, Grad. School of Bus., Austin, TX 78712, stallaert@mail.utexas.edu

1) Preference Profiles for Personalized Web Experience, Boris Jukic, George Mason University, Sch. of Mgmt., Enterprise Hall, MS 5F4, Fairfax, VA 22030-4444, bjukic@som.gmu.edu, **Nenad Jukic**

We present an application model for the personalized delivery of online advertising and other Web content based on period adjustment of users' preference profiles. Preference profiles are created and maintained implicitly, without the user's intervention, but with their consent and full control, including the ability to opt out. This process uses a combination of rule-based techniques and optimization algorithms.

2) A Market-Based Allocation Mechanism for the Differentiated Services Framework, Manoj Parameswaran, University of Maryland, Smith Sch. of Bus., 4350 Van Munching Hall, College Park, MD 20742, pem@rhsmith.umd.edu, **Jan Stallaert**

A multi-tier service model such as DiffServ needs to have economic resource allocation mechanisms that provide the right incentives to users and network providers to sustain it. We outline a market-based allocation mechanism designed in a decentralized fashion to complement the DiffServ model and to facilitate economic allocations for a premium service-based model.

3) Selection of Knowledge Projects using an Internal Market Mechanism, Jan Stallaert, University of Texas, Dept. of MS/IS, CBA 5.202, Grad. School of Bus., Austin, TX 78712, stallaert@mail.utexas.edu

We propose an intra-organizational market mechanism to decide on knowledge investments. We allow bids on bundles of knowledge components and model knowledge as a public good within a firm. We solve the "free-rider" problem associated with the public good nature and give a valuation method for sets of knowledge components.

TD33 Queuing Modeling Subject to Power-Tail Distributions

Cluster: Queues

Invited Session

Chair: Carl M. Harris, George Mason University, Sch. of Info. Tech. & Eng., Fairfax, VA 22030, charris@gmu.edu

1) Utilizing Power-Tail Distributions in Queuing Models of Internet Traffic, Martin J. Fischer, MITREtek Systems, McLean, VA 22101, mfischer@mitretek.org, **Donald Gross, Carl M. Harris**

Internet traffic data indicate that long-tailed (power-tail, fat-tail) distributions typically serve as better models for packet interarrival times and/or service lengths. These distributions have properties that make it impossible to derive manageable queuing theory formulas for measuring congestion. We offer a plan to apply a new method for approximating Laplace transforms of arbitrary probability distributions...

2) Simulation of Queuing Problems Power-Tail Distributions in Queuing Models, Donald Gross, George Mason University, Dept. of OR & Eng., Fairfax, VA 22030-4444, dgross1@gmu.edu, **Martin J. Fischer**

Much recent research has been directed at the use of power-tail distributions in modeling congestion in the Internet. But using discrete-event simulation for such problems, for example, is fraught with difficulty because of the unusual tail

behavior inherent in these types of distributions. We propose an approach combining a new method for approximating Laplace transforms...

TD34 Simulation I

Cluster: Simulation

Invited Session

Chair: Lucien Keller, PROMODEL Corp., Orem, UT, louk@promodel.com

1) System Optimization using Simulation, *Lucien Keller*, PROMODEL Corp., Orem, UT, louk@promodel.com

Abstract not supplied.

2) Finite Capacity Scheduling, *Michael Thompson*, Autosimulations, Inc., Bountiful, UT, michael_thompson@autosim.com

Abstract not supplied.

TD35 Software Demonstration VIII

Software Demo Session

Chair: To be announced

1) Dash Optimization, Inc.: XPRESS-MP - A Fully Integrated Modeling & Optimization System, *Sebastian Ceria*, Dash Optimization, Inc., 115 River Rd., Ste. 1203, Edgewater, NJ 07020, sceria@dashopt.com

XPRESS-MP is a state-of-the-art software solution for modeling and optimization. We will show how XPRESS-MP can be used to model and solve complex problems arising from a wide variety of applications. We will introduce our new product EMOSL, which allows users to integrate modeling and optimization into any program, thus exploiting all computational power of our optimization engines while preserving a natural description of the problem.

2) ILOG, Inc.: OPL Studio 3.0, *Irvin J. Lustig*, ILOG, 1080 Linda Vista Ave., Mountain View, CA 94043, ilustig@ilog.com

ILOG will demonstrate OPL Studio 3.0, which reduces the development time for embedding optimization within your Windows and Unix applications. With OPL Studio 3.0, models developed in the OPL Studio graphical environment can be easily embedded into programs developed in Visual Basic, Java, Microsoft Excel or C++.

Tuesday 16:30-18:00

TE01 Generalizable Insights from Medical Decision Analysis

Sponsor: Decision Analysis Society

Sponsored Session

Chair: Arthur S. Elstein, University of Illinois, Dept. of Medical Education, 808 South Wood St., MC 591, Chicago, IL 60612-7309, aelstein@uic.edu

1) Ethics & Medical Decision Making, *Scott B. Cantor*, University of Texas, Anderson Cancer Ctr., 1515 Holcombe Blvd., Box 40, Houston, TX 77030-4095, sbcantor@mdanderson.org

Decision analysis and medical decision making both acknowledge the ethical implications of their methodologies. Decision analysis in health care decisions has become a frequent practice since 1975; tradeoffs have become clearer but ethical controversies remain. We discuss contributions of medical decision making to decision analysis, focusing on ethical concerns.

2) Decision Analysis: Contributions from Medical Decision Making, *Francois Sainfort*, University of Wisconsin, Dept. of IE & Preventive Med., 1513 University Ave., Madison, WI 53706, sainfort@enr.wisc.edu

We review how the field of medical decision making has contributed to decision analysis. In particular, we focus on contributions to utility theory development, testing and application. We also discuss current challenges faced by theorists and practitioners of medical decision making.

3) Stochastic Trees in Medical Decision Modeling, *Gordon B. Hazen*, Northwestern University, IEMS Dept., Evanston, IL 60208-3119

Stochastic trees are a recent modeling innovation for medical decision analysis which graphically combine decision trees and continuous-time Markov chains. Stochastic trees can usually be factored into simpler components, a process which eases model formulation and presentation. Applications to medical cost effectiveness and medical decision analysis will be presented.

4) Medical Decision Analysis: Lessons Learned, *Arthur S.*

Elstein, University of Illinois, Dept. of Medical Education, 808 South Wood St., MC 591, Chicago, IL 60612-7309, aelstein@uic.edu

Decision analytic methods, including clinical guidelines and evidence-based medicine, were introduced into clinical medicine in response to concerns about practice variation and cost-effectiveness. Simple models, while more acceptable to physicians, don't satisfy professional standards. Complex models, however, risk disempowering physicians or being ignored. These tradeoffs depend on who wants the analysis.

TE03 Leveraging Information Technologies: Emerging Technical & Operational Opportunities & Challenges

Sponsor: Military Applications Society

Sponsored Session

Chair: Joseph Helman, Litton/TASC, Mission Analysis Section, 1101 Wilson Blvd., Ste. 1600, Arlington, VA 22209-2248, jjhelman@tasc.com

1) Advanced Technology Architecture for Information Superiority, *Edward T. Powell*, Science Applications International Corp., 1100 North Glebe Rd., Ste. 1100, Arlington, VA 22201, epowell@sito.saic.com

DARPA ISO has developed the ATAIS leveraging information technology breakthroughs to address the increasing challenges and complexities of C4I. The ATAIS is a strategy for information superiority in the 2010 timeframe using hierarchical domain specific software architectures containing a common C4I meta-model.

2) The High Level Architecture Virtual Command Post: Developing a Virtual Collaborative Environment, *John W. Shockley*, SRI International, 333 Ravenswood Ave., Menlo Park, CA 94025, john_shockley@sri.com, *Mark Morgenthaler*

The HLA VCP provides a virtual collaborative environment in which geographically distributed users can interact via 9600-baud radio links. Interaction via such low bandwidth is accomplished using shared databases and avatar representation of users. We discuss current project status.

3) Confidence & Security Building Measures in Asia/Pacific Rim Regions: Regime Concepts & Supporting Technologies, *Joseph Helman*, Litton/TASC, Mission Analysis Section, 1101 Wilson Blvd., Ste. 1600, Arlington, VA 22209-2248, jjhelman@tasc.com

The US and international communities continue to face political, strategic, military and technical challenges regarding the proliferation, testing, command and control, safety and security and accountability of weapons of mass destruction and fissile materials. We identify candidate confidence and security building regimes and arms control approaches and technologies that address specific regional and sub-regional security challenges in Asia and the Pacific Rim regions.

TE05 Scheduling I

Contributed Session

Chair: Ali Allahverdi, Kuwait University, Dept. of MIE, College of Eng., PO Box 5969, Safat, 13060, Kuwait, allahverdi@kuc01@kuniv.edu.kw

1) Scheduling to Minimize Expected Completion Time in Flowshop Plants with Uncertain Processing Times, *Jayanth Balasubramanian*, Carnegie Mellon University, Dept. of Chemical Eng., Pittsburgh, PA 15213, jayanth@andrew.cmu.edu, *Ignacio E. Grossmann*

We model the uncertainty in processing times using discrete distributions. An analytical expression for the expected completion time, based on an activity network representation of the schedule, is used to derive an MILP model. Solution times for the proposed model are orders of magnitude smaller than for standard multiperiod models.

2) The Use of Interval Graphs for the Steel-Mill Scheduling Problem, *SooYoung Chang*, Pohang University of Science & Technology, Dept. of IE, HyojaDong San 31, Pohang, Kyungbuk, 790-784, Korea, syc@postech.ac.kr, *Kangbok Lee, Taegyun Cho*

A steel-mill scheduling problem is formulated as a problem of finding the set of maximal disjoint cliques satisfying a few additional constraints. We discuss the combinatorial nature of the problem and propose a solution strategy.

3) A New Rule for Minimizing the Number of Tardy Jobs in a Dynamic Flow Shop, *Emmett J. Lodree, Jr.*, University of Missouri, E3437 Engineering Bldg. East, Columbia, MO 65211, c722983@showme.missouri.edu/http://web.missouri.edu/~c722983,

Wooseung Jang, Cerry M. Klein

We propose a new dispatching rule for minimizing tardy jobs in an m machine dynamic flow shop. This new rule is derived by dividing the problem into several 1-machine sub-problems and using a variation of Moore's algorithm to solve each sub-problem. Computational results confirm the effectiveness of the rule.

4) A Process Approach to Batting Order Optimization under Uncertainty, Joel S. Sokol, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, jsokol@isye.gatech.edu, http://www.isye.gatech.edu/~jsokol

Treating baseball as a run-scoring process, we quantify the game's traditional notions of table-setters and run-producers. We propose an intuitive algorithm that runs much faster than the previous best heuristic, generates solutions that are empirically near-optimal and remains robust under uncertainty in player skill measurement.

5) m-Machine Flowshop Scheduling to Minimize Total Completion Time, Ali Allahverdi, Kuwait University, Dept. of MIE, College of Eng., PO Box 5969, Safat, 13060, Kuwait, allahverdi@kuc01@kuniw.edu.kw, **Tariq Aldowaisan**

The m-machine flowshop-scheduling problem is addressed with respect to total completion time criterion. Several heuristic algorithms are proposed and compared with the best-known heuristics. Extensive computational experiment shows that the proposed heuristics perform better than the best heuristic in terms of both the average error and computation time.

TE07 New Product Development**Contributed Session**

Chair: Kioumars Paryani, General Motors Corp. Truck Group, Truck Product Ctr., 2000 Centerpoint MC 4835112K2, Pontiac, MI 48341, kioumars.paryani@gm.com

1) An Analytic Model of Stretch Target Setting in Product Development, Mustafa Sefik, Wayne State University, Dept. of IME, 4815 Fourth St., Detroit, MI 48202, sefik@mie.eng.wayne.edu, **Kenneth R. Chelst**

Jack Welch of GE coined the term "stretch targets" as a managerial strategy that was later widely copied. However, the key decision, "How far to stretch?" has never been structured or modeled. We present a 1-variable probabilistic model that answers this question. We also frame a multi-variable extension.

2) Customer-Driven Organizations: Managing New Product Development & Life Cycles, Nouri Beyrouti, Lebanese American University, Sch. of Bus., Beirut, Lebanon, nbeyrouti@beirut.lau.edu.lb

Today, customer-oriented businesses focus on shortening time-to-market, reducing costs and increasing product quality in the design and manufacture of new products. Customer or marketplace requirements must also be accurately translated into relevant technical descriptors throughout each stage of product and market development...

3) The Study for Modular Design of Products Considering Disassemblability, Hwang Hwang Hoon, Pusan National University, Dept. of IE, Changjeon-Dong, Kumjeong-Ku, Pusan, 609-735, Korea, hwanghoon@hotmail.com, **Tae-Il Yang, Chae-Yong Lee, Hak Soo Mok**

To propose guidelines of modular design for improvement of ease of disassembly, product structure must be considered. By analyzing characteristics of structure of subassembly, influencing factors of the module can be defined and classified. Based on the determination factor of influencing factor of module, criteria for the improvement of ease of use of disassembly can be obtained...

4) Optimal Product Design & Positioning, Sriram Kannan, University of Cincinnati, QAOM Dept., College of Bus. Admin., Cincinnati, OH 45221, kannans@econqa.cba.uc.edu, **Jeffrey D. Camm, James J. Cochran**

We discuss formulation of the product design problem using conjoint analysis as a binary integer program. Solution approaches include a combination of Lagrangean relaxation and constraint programming techniques.

5) A Consumer-Based Product Development Decision Support System, Kioumars Paryani, General Motors Corp. Truck Group, Truck Product Ctr., 2000 Centerpoint MC 4835112K2, Pontiac, MI 48341, kioumars.paryani@gm.com

We present quality function deployment (QFD) as a DSS that integrates multiple facets of marketing and engineering information to enhance the quality and output of the product development decision making. We show how QFD, in conjunction with other engineering tools, provides the framework for an

alternative sequence of steps involved in various decision making throughout product development...

TE08 Multivariate Stochastic Orders & Dependence

Sponsor: Applied Probability Society

Sponsored Session

Chair: Alfred Muller, Universitat Karlsruhe, Inst. Wirtschaftstheorie & OR, Kaiserstr. 12, Geb. 20.21, Karlsruhe, 76128, Germany, mueller@wior.uni-karlsruhe.de

1) Aging & Dependence for Time-Transformed-Exponentials, Bruno Bassan, Universita La Sapienza, Dept. de Matematica, Piazzale Aldo Moro 5, Roma, I-00185, Italy, bassan@mat.uniroma1.it, **Fabio Spizzichino**

We consider a particular class of distributions of positive, exchangeable random variables. We analyze compatibility relations among dependence, Bayesian multivariate aging and 1-dimensional aging properties and study how surviving affects dependence among residual lifetimes.

2) Stochastic Models for Dependent Life Lengths Induced by Common Pure Jump Shock Environments, Haijun Li, Washington State University, Dept. of Pure & Applied Math, Pullman, WA 99164, lih@haijun.math.wsu.edu

The lifelengths of components of a system are usually dependent due to common random production and operating environments. We introduce a multivariate pure jump Markov process to describe a large class of damage processes on various system components driven by common environmental shocks. We establish some dependence properties (association) for such a process and its multivariate increment process...

3) Some Results on Multivariate Stochastic Orders & Dependence Concepts, Alfred Muller, Universitat Karlsruhe, Inst. Wirtschaftstheorie & OR, Kaiserstr. 12, Geb. 20.21, Karlsruhe, 76128, Germany, mueller@wior.uni-karlsruhe.de, **Marco Scarsini**

We consider multivariate stochastic order relations. By using directionally convex order, we will show how the variability of functionals such as the sum of the components is affected by the dependence structure, i.e., the copula, and by the variability of the marginals. We indicate some applications to queueing and finance.

TE09 Logistics III

Contributed Session

Chair: Rene M. B. De Koster, Erasmus University Rotterdam, Rotterdam Sch. of Mgmt., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, rkoster@fbk.eur.nl, http://www.fbk.eur.nl/FBK/VG6

1) Inventory Models for Deteriorating Items with Shortages & Two Warehouses, Jinn-Tsair Teng, National Tsing Hua University, Dept. of IE & EM, Hsinchu, Taiwan, 30043, ROC, jteng@ie.nthu.edu.tw, **Maw-Sheng Chern**

In contrast to the traditional deterministic 2-warehouse inventory model with shortages at the end of each replenishment cycle, we propose an alternative model which ends without shortages in each cycle. In addition, we investigate the conditions under which a 2-warehouse inventory model is less expensive to operate than a single-warehouse model.

2) A Closed Queueing Network Model for the Performance Evaluation of the Multi-Echelon Repair System, Hyo-Seong Lee, Kyung Hee University, 1 Seocheon, Kiheung, Yongin, Kyunggi-do, 449-701, Korea, hslee@nms.kyunghee.ac.kr, **Chanwoo Park, Changgon Kim**

An approximate method is developed to obtain the performance measures for the multi-echelon repair system. The system is modeled as a closed queueing network and is analyzed using a product-form approximation method. A recursive technique is used to solve the sub-network.

3) Distribution Structures for On-Line Food Retailers, Rene M. B. De Koster, Erasmus University Rotterdam, Rotterdam Sch. of Mgmt., PO Box 1738, Rotterdam, 3000 DR, The Netherlands, rkoster@fbk.eur.nl, http://www.fbk.eur.nl/FBK/VG6

Although on-line sales are booming, they still lag in the food sector. Both e-commerce-only companies and companies with both on-line activities and ordinary stores make losses. We study the distribution structure of these companies and argue which distribution structure is most likely to become profitable in the future.

TE10 Production & Scheduling II

Contributed Session

Chair: Hui Liu, Northwestern University, Dept. of IE/MS, Evanston, IL 60208-3119, hui@iems.nwu.edu

1) Using Network Flow Modeling with Deviation Variables to Coordinate Scheduling/Routing of Products through a Manufacturing System, Hojjat Mehri, Youngstown State University, 100 Squires Ct., Canfield, OH 44406, hmehri@cc.ysu.edu

Traditional multistage, manufacturing systems need to centralize their production planning and scheduling activities as an essential first step in their attempt to adapt the lean manufacturing philosophy. We discuss a network-based model designed to assist in the monitoring of product flow and coordination of production planning/scheduling within a manufacturing complex...

2) Multi-Item Stochastic Inventory Models with Advance Demand Information & Production Flexibility, Ozalp Ozer, Columbia University, 435 West 119th St., Apt. 4F, New York, NY 10027, ozalp@ieor.columbia.edu, <http://www.ieor.columbia.edu/~ozalp>, **Guillermo Gallego**

We study a multi-item periodic review inventory model with advance demand information and lower and upper bounds on production quantities that reflect limits of manufacturing flexibility due to contractual agreements. We develop heuristics based on solution of an aggregate dynamic program. We conduct numerical studies to provide additional insights for the drivers of system performance.

3) Minimizing the Total Job Waiting Time between Machines in a Two-Stage Flow Shop, Renato E. de Matta, University of Iowa, 108 Pappajohn Bus. Admin. Bldg, Iowa City, IA 52242, renato-dematta@uiowa.edu, **Rodney Traub**

We study a deterministic 2-machine flow shop problem with job setups where the total time jobs wait after they have been completed on machine 1 and prior to being processed on machine 2 is minimized. Our solution approach solves 60 job problems to optimality within a reasonable amount of time.

4) On the Asymptotic Optimality of Some Online Heuristics for the Flow Shop Problem with Release Dates, Hui Liu, Northwestern University, Dept. of IE/MS, Evanston, IL 60208-3119, hui@iems.nwu.edu, **David Simchi-Levi**

We perform a probabilistic analysis of the flow shop weighted completion time problem with release dates. We prove that a number of on-line algorithms, including the weighted shortest processing time among job heuristics, are asymptotically optimal.

TE11 Statistical Methods for Reliability

Sponsor: Quality, Statistics & Reliability

Sponsored Session

Chair: Paul Kvam, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205

1) Confidence, Likelihood & Reliability, Russel Boyles, Boyles Consulting & Training, 3099 Rosemary Ln, Oswego, OR 97034

There has been recent movement towards the use of likelihood methods for analyzing reliability data. The need arose from the inability of classic statistics to handle sophisticated models and complex censoring patterns. The use of likelihood-based confidence intervals is the cornerstone of this approach. Classic solutions exist for simple reliability problems in basic engineering statistics courses...

2) Cumulative Damage Models for Strength of Materials, William J. Owen, UNH, Dept. of Math & Stats., Durham, NH 03824

We will review the theoretical development of cumulative damage models and the areas of current research applied to strength testing of composite materials. Various damage models will be derived. The models will be shown to have a similar distributional form and will be compared using composite strength test data.

3) Using a Genetic Algorithm to Optimize the Availability of a Complex Industrial Manufacturing Process, Harry F. Martz, Los Alamos National Lab., Group TSA-1, Los Alamos, NM 87545

A discrete-event simulation model of a complex consumer products manufacturing process is described. The process consists of multiple manufacturing modules (subsystems), each of which contains 1 or more parallel coupled or uncoupled operating lanes. The manufacturing modules are separated by in-process buffers. A GA is used to determine high-availability process designs and operating rules.

4) Wavelet Network for Handling Large Volumes of

Information, Di Chen, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205

We present an intelligent wavelet network that identifies key data features and allocates them into multi-resolution priority classes. This network uses wavelets to capture local singularities and Fourier transforms to model global trends. Examples from thin-film semiconductor and wireless antenna manufacturing processes illustrate our ideas.

TE12 Network Design & Applications

Cluster: Networks

Sponsor: Optimization Section

Sponsored Session

Chair: J. Scott Provan, University of North Carolina, Dept. of OR, CB 3180, Chapel Hill, NC 27599-3180, scott_provan@unc.edu

1) Steiner Trees & 3-D Macromolecular Conformation, J. MacGregor Smith, University of Massachusetts, PO Box 9397, North Amherst, MA 01059, jmsmith@snail.ecs.umass.edu

A current major problem in biochemistry and molecular modeling is the determination of 3-D minimum energy configurations for macromolecular structures such as for proteins and DNA. Steiner minimal trees are seen as a useful algorithmic paradigm for modeling these structures. We examine how Steiner minimal trees (SMTs) and the Steiner ratio value comparing minimum spanning trees...

2) Game-Theoretic Models for Diverse Routing, Douglas Robert Shier, Clemson University, Dept. of Math. Sci., Martin Hall, Clemson, SC 29634-1907, shierd@clemson.edu, **Jim Brumbaugh-Smith**

We discuss a class of game-theoretic models for the analysis and design of (failure-prone) communication networks, in which both diversity and shortness of routes are desired. Exact algorithms are developed that incorporate bicriterion shortest path procedures as well as heuristic techniques. Computational results are also presented.

3) Algorithms for Constructing Survivable Networks on the Plane, J. Scott Provan, University of North Carolina, Dept. of OR, CB 3180, Chapel Hill, NC 27599-3180, scott_provan@unc.edu, **Emily Luebke**

We report on the implementation of an algorithm to construct Euclidean-length networks interconnecting a set of points in the plane and invulnerable to destruction of a single edge or vertex. The algorithm is patterned after current algorithms for the standard Steiner tree problem by intelligently constructing solutions from full Steiner subtrees.

TE13 Forecasting

Contributed Session

Chair: John F. Wellington, Capital University, Grad. Sch. of Admin., 2199 East Main St., Columbus, OH 43209, jwellington@capital.edu, <http://www.capital.edu/gsa>

1) Forecasting the Long-Term Demand for Automobiles: A Dynamic Nested-Logit Approach, Wilm Eggert, DaimlerChrysler AG, Wilhelm-Runge-Str. 11, Ulm, D-89081, Germany, wilm.eggert@daimlerchrysler.com

Forecasting the long-term demand for automobiles requires market models that account for the relevant characteristics of automobile markets. We present a study of the German automobile market using a dynamic nested-logit approach which considers differentiation among products and customers, complex substitution patterns, market segmentation and dynamic market effects.

2) Combining Neural Networks with a Box-Jenkins Model for Time Series Forecasting, Guoqiang P. Zhang, Georgia State University, Coll. of Bus., 35 Broad St. NW, Atlanta, GA 30303, gpzhang@gsu.edu

Neural networks have been used as an alternative approach to traditional linear time series methods for forecasting. We propose a mixed methodology combining both Box-Jenkins models and neural networks. The effectiveness of the hybrid model will be discussed.

3) Least Square Estimation & Linear Programming, Nelson F. Maculan, Federal University of Rio de Janeiro, COPPE - Sistemas, PO Box 68511, Rio de Janeiro, 21945-970, Brazil, maculan@cos.ufrj.br, **David Benaroch, Silvio R. B. de Gouvea**

The least square estimators are sensitive to the assumption that the residues are normally distributed. In many applications, however, the residuals present different distributions. For these cases, an interactive method is suggested using LP with satisfactory results.

4) The Bias Inherent in Statistical Modeling Criteria, Martin S. Levy, University of Cincinnati, Dept. of QAOM, PO Box 210130, Cincinnati, OH 45221, martin.levy@uc.edu, James J. Cochran

Many statistical procedures can be formulated as maximal covering problems. Cochran, Camm & Levy (1999) demonstrate that the solution to the maximal covering problem, when solved over sample data, is positively biased. Thus, this result extends to various statistical procedures and the model selection/optimization criteria are revealed to be biased.

5) Forecasting Domestic Consumption of Beer, John F. Wellington, Capital University, Grad. Sch. of Admin., 2199 East Main St., Columbus, OH 43209, jwellington@capital.edu, http://www.capital.edu/gsa, Michael J. Messina, Subhash C. Narula

We develop a model for forecasting domestic beer consumption. The least squares principle has been used to estimate the parameters of such models. We propose an alternate principle. We illustrate, compare and contrast the forecasting models developed under both principles with industry data.

TE14 Nonlinear Optimization in Marketing

Cluster: Nonlinear Programming

Sponsor: Optimization Section

Sponsored Session

Chair: Leon S. Lasdon, University of Texas, MSIS Dept., College of Bus. Admin., Austin, TX 78712-1175, lasdon@mail.utexas.edu

1) Mathematical Modeling & Optimization for Strategic Decision Making in Customer Relationship Management, Timothy L. Smith, Trajecta, Inc., 611 South Congress Ave., Austin, TX 78704, tsmith@trajecta.com, Abhijit Chatterjee

We present robust optimization models for CRM. These include uncertainty about customer behavior, constraints such as multiple customer segments and maximize lifetime customer value. We present results of solving multi-segment and single-segment optimization models and compare with heuristic approaches. We discuss the value of this approach in several applications.

2) Results from Optimizing Customer Relationship Management in the Credit Card Industry, Abhijit Chatterjee, Trajecta, Inc., 611 South Congress Ave., Austin, TX 78704, tsmith@trajecta.com, Timothy L. Smith, Leon S. Lasdon

We apply the modeling framework described in the previous presentation to problems involving repricing credit limit, APR and fees, acquisition of new customers and collections. We describe data sources, data preprocessing, neural network modeling and single- and multi-scenario LP model formulations. Results are presented for a major credit card issuer.

3) Optimization Models for Sales Force Management, Glenn Sabin, ZS Associates, 1800 Sherman Ave., Ste. 700, Evanston, IL 60201, gsabin@zsassociates.com, Pieter A. Sheth-Voss, Songjun Luo

Sales forces can exceed 5000 sales reps organized into a dozen teams with overlapping responsibilities and cost one-third of corporate revenues. We present an optimization model to assist in strategic sales force design decisions including the number of reps, number of teams and team responsibilities over a multi-year horizon.

TE15 Transportation I

Contributed Session

Chair: Anna Nagurney, University of Massachusetts, Isenberg Sch. of Mgmt., Amherst, MA 01003, nagurney@gbfin.umass.edu, http://www-unix.oit.umass.edu/~nagurney/

1) Planning of Shipments from an Oil Refinery to Terminals by using Column Generation, Jan A. Persson, Linkoping Universitet, Opt. & Dept. of Math., Linkoping, S-581 83, Sweden, japer@mai.liu.se, www.mai.liu.se/~japer, Maud Gothe-Lundgren, Jan T. Lundgren

We formulate a model for minimizing production, inventory and transportation costs while using a fleet of tankers for meeting the forecasted demand at a set of terminals. A solution procedure based on column generation is suggested and computational results are presented for a scenario obtained from an oil refinery. computational results are presented for a scenario obtained from an oil refinery.

2) The Joint Inventory & Routing Problem, Jaeheon Jung, Case Western Reserve University, 2540 North Moreland Blvd., No. 402, Shaker Heights, OH 44120, jxj5@po.cwru.edu, Kamlesh Mathur

With an increasing emphasis on coordination in the supply chain, the inventory

and distribution decisions which in most part had been dealt with independently by each other need to be considered jointly. We consider a distribution system consisting of one warehouse and N retailers that face external demand at a constant rate. Inventories are kept at retailers as well as at the warehouse...

3) A Multiclass, Multicriteria Traffic Network Equilibrium Model with Elastic Demand, Anna Nagurney, University of Massachusetts, Isenberg Sch. of Mgmt., Amherst, MA 01003, nagurney@gbfin.umass.edu, http://www-unix.oit.umass.edu/~nagurney/, June Dong

We develop a traffic network equilibrium model in which travelers of a class perceive their travel disutility as a weighting of travel time and cost. The formulation, qualitative analysis and computational procedure are based on variational inequality theory.

TE16 Models for Efficient Use of Air Transportation Resources

Sponsor: Transportation Science Section

Sponsored Session

Chair: Robert L. Hoffman, Metron Scientific Consultants, 11911 Freedom Dr., Ste. 800, Reston, VA 22090-5602, hoff@metsci.com

1) Modeling Airline Ground Operations, Kari Andersson, MIT, OR Ctr., Cambridge, MA 02139, William D. Hall, Eric Feron

We investigate the impact that air traffic management would have on delays and fleet/passenger connections if it could accommodate an airline's arrival sequence preferences. We also investigate the effect of uncertainty on airline operational efficiency. The IP schedules landing, gate arrival and departure times considering gate capacity and airline resources required to turn the aircraft.

2) An Integrated Model of Air Transport Networks, System Fragility & Economic Impacts, Peter Chen, University of Illinois, Dept. of Civil & Environ. Eng., 1213 Newmark Civil Eng. Lab., Urbana, IL 61801, pschen@uiuc.edu, David Bartolai, Jennifer Gilbert, Hank Hsing, Michelle Karow

We present an integrated model to assess the potential impact on air transport networks due to interruption of access to an airport or a group of airports, including airline passenger and cargo forecasting. Airport closures may be caused by natural or man-made disasters. Results for the Mid-America earthquake region are discussed.

3) Benders Decomposition for Simultaneous Aircraft Routing & Crew Scheduling, Jean-Francois Cordeau, GERAD, Ecole des HEC, 3000 Cote-Sainte-Catherine, Montreal, Quebec, H3T 2A7, Canada, cordeau@crt.umontreal.ca, Goran Stojkovic, Francois Soumis, Jacques Desrosiers

We describe a model and a solution approach based on Benders decomposition for solving the simultaneous aircraft routing and crew scheduling problem. In this decomposition, both the master problem and the subproblem are optimized by column generation. Preliminary computational results are reported on problems involving several hundred flights.

4) Collaborative Air Traffic Management of Enroute Resources, Robert L. Hoffman, Metron Scientific Consultants, 11911 Freedom Dr., Ste. 800, Reston, VA 22090-5602, hoff@metsci.com, Michael O. Ball

Until recently, CTFM efforts in the National Airspace System have been aimed largely at airport arrival resources. The aviation community is now searching for ways to carry existing CTFM paradigms to the enroute setting. We discuss rationing schema and collaborative solutions for management of enroute resources within the National Airspace System.

TE17 Characterizing Traffic Flow

Sponsor: Transportation Science Section

Sponsored Session

Chair: Elizabeth G. Jones, University of Nebraska, Civil Eng. Dept., 203E PKI Bldg., 6001 Dodge St., Omaha, NE 68182-0178, egjones@unomaha.edu

1) Capacity Reliability of a Road Network: An Assessment Methodology, Anthony Chen, Utah State University, Dept. of Civil & Environ. Eng., Logan, UT 84322-4100, achen@cc.usu.edu

We introduce a capacity reliability for road networks with random link capacity. It is defined as the probability that the road network can accommodate a certain level of traffic demand and is built on the concept of network reserve capacity. The proposed capacity reliability index includes connectivity reliability as a special case...

2) **A Sufficient Condition for the Occurrence of the Braess Paradox**, *Jane N. Hagstrom*, University of Illinois, Dept. of Info. & Dec. Sci., 601 South Morgan, MC 294, Chicago, IL 60607, hagstrom@uic.edu, *Robert A. Abrams*

The original Braess paradox describes a situation in which adding a link to a network increases the travel time. We obtain sufficient conditions for the occurrence of a generalized Braess paradox in a multi-source, multi-sink network with nonlinear travel costs.

3) **A New Method of Incident Detection & Capacity Estimation for Signalized Streets**, *Li-Kuo Rau*, Purdue University, Sch. of Civil Eng., 1284 Civil Eng. Bldg., West Lafayette, IN 47907, likuo@ecn.purdue.edu, *Andrzej P. Tarko*

We present a novel idea of using the metering effect of traffic signals to estimate capacities of signalized intersections. By tracking the capacity estimates over time, unexpected changes in these capacities can be detected and attributed to incidents. Simulation experiments indicate that the new approach is feasible.

4) **Application of the Two-Fluid Model to Characterize Traffic Flow at Signalized Intersections: Simulation Results**, *Elizabeth G. Jones*, University of Nebraska, Civil Eng. Dept., 203E PKI Bldg., 6001 Dodge St., Omaha, NE 68182-0178, egjones@unomaha.edu

The 2-fluid model appears to have scalable qualities that would allow it to be validated at scales other than a network scale. Data collection at signalized intersections has supported this scalability concept. Our current work presents results from simulations focusing on validation of the model's assumptions at the intersection scale.

TE18 Education

Contributed Session

Chair: Yun Wang, Mercy College, Math/CIS Dept., 555 Broadway, Dobbs Ferry, NY 10522, ywang@mercynet.edu

1) **Resource Allocation in Academic Settings**, *Jay B. Ghosh*, SQU, PO Box 20, Al-Khod Postal Code 123, Muscat, Oman, jghosh@squ.edu.om, *Sunil Dharmapala*, *Hussein M. Saber*

Resource allocation issues arise frequently in academia. Recruitment, salary adjustment and research funding decisions are a few examples. Approaches to the problem vary but in general the objective is to find a solution that is fair both in internal and external contexts. We give new formulations and solution methods.

2) **Improving the Effectiveness of Teaching Production/Operations Management**, *Edward K. Chu*, California State University, School of Mgmt., 1000 East Victoria St., Carson, CA 90747, echu@soma.csudh.edu

An outcome-based paradigm of teaching production/operations management is proposed. In this approach, course materials are structured according to functions, situations are introduced to develop problem solving skills and assessments are based on performance.

3) **Combining DEA & Factor Analysis to Improve Evaluation of Academic Departments given Uncertainty about the Output Constructs**, *S. Claudina Vargas*, University of Iowa, 519 South Scott Blvd., Iowa City, IA 52245, scvargas@icaen.uiowa.edu, *Dennis L. Bricker*

Using the CCR output-oriented model, we evaluate the performance of a university's academic departments relative to their national peers. We claim that an academic department often maximizes the levels of some unknown constructed outputs. Combining DEA and factor analysis helps improve the ranking process and overcomes some limitations of the model.

4) **A Comprehensive Approach to Teaching CS238 (Visual Basic Programming)**, *Yun Wang*, Mercy College, Math/CIS Dept., 555 Broadway, Dobbs Ferry, NY 10522, ywang@mercynet.edu

VB programming has been adopted as an entry-level programming course in computer information science curricula at many colleges. Studying effective approaches to teaching VB has brought tremendous interest in academic communities. We document a comprehensive VB teaching approach and offer a summary report for future improvement.

5) **withdrawn - author request of 3/4**, *Leonard J. Kelly*, RPI, Lally Sch. of Mgmt. & Tech., 2 Cranwood Rd., Ledyard, CT 06339, kelly@rth.edu

TE19 OR/MS in Forestry

Cluster: Forestry

Sponsor: ENRE/IFORS

Sponsored Session

Chair: Andres Weintraub, University of Chile, Dept. of IE, PO Box 2777, Santiago, Chile

1) **The Impact of Management Unit Size on Forest Management Planning under Uncertainty**, *David L. Martell*, University of Toronto, Fac. of Forestry, 33 Willcocks St., Toronto, Ontario, M5S 3B3, Canada, martell@smokey.forestry.utoronto.ca

Forest management unit boundaries have typically been determined by geographic and administrative concerns and to a much less extent, by ecological processes. We investigate the impact of management unit size on planning in boreal forest landscapes influenced by uncertain climate, ecological and human processes that operate over large spatial and temporal scales.

2) **Strategic Planning in Forestry**, *Mikael Ronnqvist*, Linköping University, Div. of Optimization, Linköping, SE-58183, Sweden, miron@mai.liu.se, *Jenny Karlsson*

An important aspect of harvest planning is to decide which and in what sequence harvest areas are to be cut and which harvest team will do it. The solution process is based on solving a large IP model where the possible sequences for the logging crews are important variables. Results from a case study at a major Swedish forest company are presented.

3) **Economic Risk Management in Forestry & Forest Industry & Environmental Effects in a Turbulent World Economy**, *Peter Lohmander*, Swedish University of Agricultural Sciences, Dept. of Forest Economics, Fac. of Forestry, Umea, S-901 83, Sweden, peter.lohmander@sekon.slu.se, <http://www.sekon.SLU.se/~plo>

Long-term predictions of economic conditions and environmental states are not very reliable. Recent research results show that optimal decisions and economic values in a turbulent environment are often quite different from the traditional solutions based on deterministic assumptions. A general research program and recent results are shown.

4) **A Tabu Search Approach for Adjacency & Old Growth Forest Planning**, *Felipe Caro*, University of Chile, Dept. of IE, PO Box 2777, Santiago, Chile, fcaro@dii.uchile.cl, *Miguel Constantino*, *Isabel Martins*, *Andres Weintraub*

Spatial forest problems can include constraints on adjacency as well as on minimum areas of old growth patches, which make the problem more complex combinatorially. We present a TS algorithm to solve this problem. Computational results on representative multiperiod cases are shown.

5) **A Decision Support System for Customer Optimized Wood Chains**, *Bertil Liden*, SkogForsk, Forestry Research Inst., Uppsala Science Park, Uppsala, SE 751-83, Sweden, bertil.liden@skogforsk.se, *Mikael Ronnqvist*

The bucking of trees and the production of lumber are typical diverging flows. A Swedish sawmill often produces 2000 different products. We present an integrated optimization system that can analyze the possibilities for the subsystem forestry-sawmill-planing mill to become more customer-oriented. The primary modeling components are the bucking, sawing and planing processes.

TE20 State Dependent Queues

Cluster: Math Modeling/Stat Inference/Comp Methods in Queuing System

Invited Session

Chair: Percy H. Brill, University of Windsor, Dept. of MS, Windsor, Ontario, N9B 3P4, Canada, brill@uwindsor.ca

1) **Tools for the Symbolic Computation of Moments via Transforms**, *Steve Drekić*, University of Toronto, Dept. of Stats., Toronto, Ontario, M5S 3G3, Canada, dreki@utstat.toronto.edu, *James Stafford*

In many queuing applications, transforms are used as a means of deriving moments of quantities such as waiting time and queue length. We describe a collection of procedures useful for automating these kinds of tedious mathematical computations. The procedures are illustrated with examples involving general and specific distributions.

2) **Web Site Performance & the M/P/1 Queue**, *Martin J. Fischer*, MITREtek Systems, McLean, VA 22101, mfischer@mitretek.org

We discuss the role that the M/Pareto/1 queue has in analyzing congestion of Web sites. The structure of a Web site and where the M/P/1 queue fits within this structure will be presented. Numerical methods for obtaining the state probabilities of M/P/1 will be given.

3) **Queuing Flexibility**, *Marvin Mandelbaum*, York University, Dept. of Comp. Sci., Toronto, Ontario, M3J 1P3, Canada,

mandel@yorku.ca, *Percy H. Brill*

We present measures of flexibility for queuing systems that process multiple customer types by different servers in parallel. A variety of queuing systems are studied. The measures proposed provide a means for comparing the flexibilities of alternative queuing systems. A calculus of flexibility measures is presented.

4) **Analysis of State Dependent M/G/c Queues**, *Percy H. Brill*, University of Windsor, Dept. of MS, Windsor, Ontario, N9B 3P4, Canada, brill@uwindsor.ca, *Carl M. Harris*

We analyze the probability distribution of the workload and the number in the system for M/G/c queues, where the arrival rate depends on the current workload. The results obtained generalize standard results for M/G/c queues.

TE22 Panel: Research in Knowledge & Technology - The Accounting Information Systems Perspective

Cluster: Knowledge & Technology
Invited Session

Chair: Kay Nelson, University of Utah, Sch. of Accounting, 1645 East Campus Dr., Rm. 108, Salt Lake City, UT 84112, actkn@business.utah.edu

1) **Panel: Research in Knowledge & Technology - The Accounting Information Systems Perspective**, *Kay Nelson*, University of Utah, Sch. of Accounting, 1645 East Campus Dr., Rm. 108, Salt Lake City, UT 84112, actkn@business.utah.edu, *Martha M. Eining*, University of Utah, Sch. of Accounting, 1645 East Campus Dr., Rm. 108, Salt Lake City, UT 84112, actme@business.utah.edu, *Taylor R. Randall*, University of Utah, Sch. of Accounting, 1645 East Campus Dr., Rm. 108, Salt Lake City, UT 84112, actr@business.utah.edu, *Kijo Cho*

No abstract supplied.

TE23 Derivatives in Energy Pricing

Cluster: Energy
Sponsor: ENRE

Sponsored Session

Chair: John R. Birge, Northwestern University, McCormick Sch. of Engineering, 2145 Sheridan Rd., Evanston, IL 60208-3100, jrbirge@nwu.edu

1) **An Option-Based Approach to Real Asset Valuation through Simulation**, *Shijie Deng*, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, deng@isye.gatech.edu

We examine a financial asset pricing approach for valuing a real asset that derives its value from its embedded operational options. Operating characteristics of the real asset such as set-up cost and lead-time are incorporated into the valuation. The optimal operating policy is derived and is obtained through simulation.

2) **Coupled Real Options & the Value of Energy Assets**, *Brad Romine*, Stanford University, ESOR Dept., Stanford, CA 94305, *Blake Johnson*

Coupled real options are a sequence of options that interact with each other. Exercising one option creates another and finally, through a series of options, one may return to the original option. A constructive proof of the existence of solutions leads to a computational algorithm for solving coupled options. Using the algorithm, the value of a natural gas storage facility and a thermal power plant are derived.

3) **Option Valuation for Power Generation with Startup & Shutdown Costs**, *John R. Birge*, Northwestern University, McCormick Sch. of Engineering, 2145 Sheridan Rd., Evanston, IL 60208-3100, jrbirge@nwu.edu, *Steve Kou*

Option methods have been used to evaluate generation resources as functions of electricity and fuel prices. Startup and shutdown costs present difficulties for these evaluations however. We will present a model for incorporating these costs into the evaluation.

TE24 Environmental Decision Making

Cluster: Green Manufacturing
Invited Session

Chair: Jonathan Linton, Polytechnic University, Dept. of Mgmt., 6 Metrotech Ctr., Brooklyn, NY 11201, jlinton@poly.edu

1) **E-Commerce & the Infomediary as an Enabling Technology for Product Recovery**, *Jonathan Linton*, Polytechnic University, Dept. of Mgmt., 6 Metrotech Ctr., Brooklyn, NY 11201,

jlinton@poly.edu

Challenges posed by uncertain timing and quantity of returns, the need to balance demand with returns, uncertainty in material recovered from returned items and requirement for a reverse logistics network have reduced the profitability of some product recovery operations and acted as a barrier to product recovery for other products. The rise of buyer-owned or third-part intermediaries or infomediaries will reduce these barriers...

2) **Cleaner Technologies for an Electroplating Shop**, *Larry Jenkins*, Royal Military College of Canada, Dept. of Bus. Admin., PO Box 17000 Stn Forces, Kingston, Ontario, K7K 7B4, Canada, jenkins-l@rmc.ca

The Canadian Navy's Fleet Maintenance Unit uses electroplating to build up worn metal parts. Since the electroplating shop will soon be relocated, this affords an opportunity to replace some activities with "greener" alternatives. We summarize the financial and environmental cost analysis and recommendations for changes in the new facility.

3) **Remanufacturing Aggregate Production Planning: An Investigation**, *Vaidy Jayaraman*, Washington State University, Dept. of Mgmt. & Systems, 14204 NE Salmon Creek Ave., Vancouver, WA 98686-9600, jayaraman@vancouver.wsu.edu, *V. Daniel R. Guide, Jr.*

We develop a model of a production system with remanufacturing capability which can be used to explore the effects of different demand patterns, production and disposal costs on the economic viability of remanufacturing schemes.

TE25 E-Business & Business-to-Business E-Commerce

Cluster: Business-to-Business E-Commerce
Invited Session

Chair: Robert F. Easley, University of Notre Dame, College of Bus. Admin., Mgmt. Dept., Notre Dame, IN 46556-0399

1) **ERP & E-Business**, *Vincent A. Mabert*, Indiana University, Kelley Sch. of Bus., 1309 East 10th St., Bloomington, IN 47405-1701, *Ashok K. Soni*, *M. A. Venkataraman*

Most ERP vendors have developed portals where sourcing transactions can occur seamlessly. Given that more than 50 vendors are involved in providing ERP systems to firms, this phenomena provides opportunities and poses challenges for suppliers. Survey-based results on the current state of this system will be presented.

2) **Information Systems Design for Business-to-Business Commerce**, *Manoj Parameswaran*, University of Maryland, Smith Sch. of Bus., 4350 Van Munching Hall, College Park, MD 20742, pem@rhsmith.umd.edu

Companies are increasingly using the Internet to gain a closer alignment with partners to improve operation efficiency. In many instances, a firm may have to establish short-term relationships with a number of firms. We discuss the challenges and issues in designing a flexible inter-organizational information system to facilitate B2B commerce.

3) **Distribution System Design: Electronic Commerce Policy & Performance Considerations**, *Elliot Bendoly*, Indiana University, Kelley Sch. of Bus., 1309 East 10th St., Bloomington, IN 47405-1701, ebendoly@indiana.edu, *M. A. Venkataraman*

The e-business environment requires quick response to meet rising demand in the market, especially in the case of B2B transactions. We propose a simulation-based optimization system to evaluate a firm's current distribution system and supplier network to address this added complexity. Computational results for outbound logistics are presented.

TE26 System Design for Effective Logistics Management

Sponsor: Section on Logistics
Sponsored Session

Chair: Ronald S. Tibben-Lembke, University of Nevada, Managerial Sci. Dept., MS 028, Reno, NV 89557, rtl@unr.edu

1) **Designing Multi-Model Transportation Networks for Regional Competitiveness**, *Mark E. Hartmann*, University of North Carolina, Kenan-Flagler Bus. Sch., Kenan Inst. of Private Enter., Durham, NC, *Noel Greis*, *Madhukirana R. Timiri*

A multi-commodity, multi-modal network flow model is developed linking air, ocean, rail and surface modes of transport into an integrated logistical network for effective and efficient supply chain connectivity. Using the Philippines as a case study, we present optimal solutions under various scenarios and sensitivity analysis on network parameters.

2) **Manufacturing & Distribution Network Design Studies in Practice**, *Tan Miller*, Warner-Lambert Company, 201 Tabor Rd., Morris Plains, NJ 07950, tan.miller@wl.com

We review a sample of manufacturing, distribution and transportation network design approaches used in practice for real world problems. In particular, we illustrate how standard OR methodologies such as optimization and simulation are combined with qualitative information and spreadsheet-type quantitative analyses to evaluate network problems.

3) **Origin, Destination & Travel Time without Surveys**, *Larry L. George*, Problem Solving Tools, 1573 Roselli Dr., Livermore, CA 94550-5852, pstlarry@home.com, <http://members.home.net/pstlarry>

We estimate origin-destination rates and travel time distributions without individual data, modeled as a network of k-dimension M/G/infinity nodes. We observe transient arrivals and departures without individual identification. Within nodes, individuals change directions randomly. We estimate change probabilities and service (travel) time distributions and reconstruct route information by product and convolution.

TE27 Finance & Risk Management III Contributed Session

Chair: Xun Li, Chinese University of Hong Kong, Dept. of SE & EM, Hong Kong, Shatin NT, PRC, xli@se.cuhk.edu.hk

1) **Portfolio Optimization under Minimax Risk Measure with Shorting**, *Chun-Hung Chiu*, Chinese University of Hong Kong, Dept. of SE & EM, Rm. 116, Ho Sin Hang Eng. Bldg., Hong Kong, Shatin NT, Hong Kong, chchiu@se.cuhk.edu.hk, *Xunyu Zhou*

Portfolio optimization under minimax risk measure with shorting is formulated as a bicriteria piecewise LP. It is then converted into a parametric optimization problem with a single combined criterion. The optimal investment strategy is derived analytically. It determines the optimal portfolio to be invested according to some simple rules.

2) **withdrawn - author request of 3/27**, *Dawei Song*, Chinese University of Hong Kong, Dept. of SE & EM, Hong Kong, Shatin NT, PRC, dwsong@se.cuhk.edu.hk, <http://www.se.cuhk.edu.hk/~dwsong>

3) **Multi-Period Portfolio Optimization under Minimax Risk Measure**, *Xun Li*, Chinese University of Hong Kong, Dept. of SE & EM, Hong Kong, Shatin NT, PRC, xli@se.cuhk.edu.hk

The multi-period portfolio selection model is studied under minimax risk measure. We formulate our problem as a bicriteria program where one is to minimize \$I/infty\$ risk function while the other is to minimize the expected return. A simple efficient algorithm is proposed in finding an optimal portfolio policy.

TE28 Difficult Combinatorial Problems

Cluster: Computational Mixed Integer Programming
Invited Session

Chair: Ellis L. Johnson, Georgia Institute of Technology, School of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, ejohnson@isye.gatech.edu

1) **Knapsack & Cyclic Group Polyhedra**, *Lisa Evans*, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, lisa@isye.gatech.edu, *Ellis L. Johnson*

2) **Computing Minimum-Weight Perfect Matchings**, *Andre Rohe*, Forschungsinstitut fuer Diskrete Mathematik, Lennestrasse 2, Bonn, D 53113, Germany, rohe@or.uni.bonn.de, *William Cook*

3) **A Combinatorial Approach to a DNA Sequencing Problem**, *Todd Easton*, Georgia Institute of Technology, Sch. of ISyE, 765 Ferst Dr., Atlanta, GA 30332-0205, teaston@isye.gatech.edu, *Eva K. Lee*

TE30 Production Planning & Supply Chain Modeling in Remanufacturing & Demanufacturing

Sponsor: MSOM
Sponsored Session

Chair: Qin Lu, Ohio State University, IWSE, 210 Baker Systems Bldg., 1971 Neil Ave., Columbus, OH 43210-1271, lu.102@osu.edu

1) **Analytical Modeling & Simulation Tools for Production Planning of Bulk Recycling**, *Qin Lu*, Ohio State University, IWSE, 210 Baker Systems Bldg., 1971 Neil Ave., Columbus, OH 43210-

1271, lu.102@osu.edu, *Vivi Christina, Julie Ann Stuart*

We analyze the difference between manufacturing and product take-back systems. We present a simulation model to test the performance of different batching strategies for bulk recycling. We develop an MILP model to schedule the batches. Our MILP model is based on process focused metrics related to cost and space.

2) **A Partial Equilibrium Model for a Supply Chain with Product Recovery & Remanufacturing**, *Erdem Eskigun*, Purdue University, School of IE, West Lafayette, IN 47907, eskigun@ecn.purdue.edu, *Reha Uzsoy, Paul V. Preckel*

A partial equilibrium model is developed for a supply chain with product recovery and remanufacturing. An equivalent NLIP model is used to find the equilibrium prices and the quantities. We show that KKT points of the NLIP model satisfy the equilibrium conditions with and without capacity expansion.

3) **A Condition-Based Production Planning Model for a Multi-Component Remanufacturing System**, *Sira Thienpaitoon*, Texas A&M University, Dept. of IE, 303P Zachry Eng. Ctr., College Station, TX 77843-3131, s0t8173@unix.tamu.edu, *Brett A. Peters, Jeffrey S. Smith*

Uncertain product conditions inherent in remanufacturing make production planning and the control of multi-component products more complex. To facilitate the production planning task, we propose a hierarchical decision support model that captures 3 major stages of remanufacturing activities: disassembly, remanufacturing and reassembly, and takes product condition into consideration.

TE32 Applications of OPL

Sponsor: Computing Society
Sponsored Session

Chair: Irvin J. Lustig, ILOG, 1080 Linda Vista Ave., Mountain View, CA 94043, ilustig@ilog.com

1) **Power Transaction Management using Constraint Programming**, *Robert Benson*, Solutions Consulting, Inc., 14523 Sandalfoot, Houston, TX 77095, rob.benson@scglobal.com

We discuss a custom supply chain application designed to increase the economic return on power transactions for a manufacturer whose largest raw material is electricity. Constraint programming was selected as the quantitative modeling framework for the application due to the discrete and nonlinear nature of the problem.

2) **Load Optimization: Beyond the TSP Model in Vehicle Routing**, *Andrzej Lewandowski*, McHugh Software International, 1000 Bridgeport Ave., Shelton, CT 06484, andrzej.lewandowski@mchugh.com

The classic formulation of VRP addresses vehicle-centric planning of transportation. In such a formulation, the utilization of vehicles is optimized. However, when specialized vendors provide transportation/warehousing operations, transportation planning become shipment-centric and the shipment route must be planned in addition to the vehicle route. Shipment route optimization can be formulated as a set of constraints...

3) **Optimal Production Distribution having Multiple Product-Mix Sensitive Toolsets**, *James R. Wuerfel*, Intel Corp., 5000 West Chandler Blvd., MS CH3-96, Chandler, AZ 85225, james.r.wuerfel@intel.com

Maximizing production over multiple factories can be a very difficult problem. We present an LP formulation with several complicating factors: varying product tool capacity, multiple toolsets which run overlapping subsets of manufacturing steps and various semiconductor manufacturing constraints. We also discuss an implementation architecture using ILOG optimization products.

TE33 Queuing Potpourri

Cluster: Queuing Potpourri
Invited Session

Chair: Alan Krinik, California State Polytech. University, 3801 West Temple Ave., Dept. of Math, Pomona, CA 91768, ackrinik@csupomona.edu

1) **Dynamic Scheduling of a Parallel Server System**, *Steven L. Bell*, University of California, San Diego, CA, sbell@euclid.ucsd.edu, *Ruth J. Williams*

We consider a queuing system with a bank of non-identical servers working in parallel, exogenous arrivals classified into one of several infinite capacity buffers and linear holding costs for each buffer. Each incoming job requires a single service that may be provided by any of several different servers; the service time of a job may depend on both its buffer and the server providing the

service...

2) A New Approach to Queuing Analysis, Gerardo Rubino, Rennes ENST Bretagne, France, gerardo.rubino@irisa.fr

We propose to numerically analyze the random variable "maximum level reached by the number of customers in a queue over a finite interval." This can lead to a very precise way to dimension systems where the queuing aspect is essential. The idea is to work in a Markovian context and to use the powerful properties of Markov models in order to derive an algorithm allowing to compute the distribution of the considered random variable...

3) RG-Factorization & Invariant Vectors for a Discrete Time Markov Chain, Yiqiang Q. Zhao, University of Winnipeg, Dept. of Math & Stats., 515 Portage Ave., Winnipeg, Manitoba, R3B 2E9, Canada, zhao@uwinnipeg.ca

Consider the transition matrix P of a discrete time Markov chain with infinitely many states. P is allowed to be either stochastic or substochastic. We show how I-P can be written as a factorization, called the RG-factorization, which is a generalization of the LU-factorization for a finite matrix to that for an infinite stochastic or substochastic matrix...

4) Busy Period Distributions in Terms of Transient Probabilities of Dual Processes, Alan Krinik, California State Polytech. University, 3801 West Temple Ave., Dept. of Math, Pomona, CA 91768, ackrinik@csupomona.edu

Our purpose is to popularize a nice connection between busy period distributions of birth-death processes in terms of the transient probability functions of their dual birth-death process. This observation provides a direct technique to obtain and identify the busy period distribution of those classic queueing systems for which transient solutions of the dual process are already known...

TE34 Simulation II

Cluster: Simulation
Invited Session

Chair: Lucien Keller, PROMODEL Corp., Orem, UT, louk@promodel.com

1) System Optimization using Simulation, Lucien Keller, PROMODEL Corp., Orem, UT, louk@promodel.com

Abstract not supplied.

2) Finite Capacity Scheduling, Michael Thompson, Autosimulations, Inc., Bountiful, UT, michael_thompson@autosim.com

Abstract not supplied.

TE35 Software Demonstration IX

Software Demo Session

Chair: To be announced

1) Frontline Systems, Inc.: Introducing the Premium Solver Platform for Microsoft Excel, Daniel H. Fylstra, Frontline Systems, Inc., PO Box 4288, Incline Village, NV 89450, dfylstra@frontsys.com

Our new Premium Solver Platform for Microsoft Excel includes a hybrid solver using evolutionary and "classic" methods for greatly improved performance and an enhanced GRG2 solver with multiple "clustering" methods for global optimization. Also included are a much-improved LP/MIP solver for mixed-integer problems and a new "all different" or permutation constraint supported by all solver engines.

Wednesday 08:30-10:00

WA01 Generalizable Lessons from Government Decision Analysis

Sponsor: Decision Analysis Society
Sponsored Session

Chair: Ronald G. Whitfield, Argonne National Laboratory, DIS-900, Argonne, IL 60439, rgwhitfield@anl.gov

Co-Chair: Thomas D. Wolsko, Argonne National Laboratory, 9700 South Cass Ave., Dis-900, Argonne, IL 60439, tdwolsko@anl.gov

1) R&D Portfolio Analysis for Department of Energy Environmental Management, Gregory S. Parnell, US Military Academy, Dept. of Systems Eng., Mahan Hall, Rm. 342, West Point,

NY 10996, gparnell@usma.edu, Sheila Jordan, David Geiser

The DoE's Office of Science & Technology is responsible for an annual budget of more than \$250M. We describe the R&D portfolio analysis we have successfully used for the past 3 years to help environmental management decision-makers select the best R&D portfolio. We also discuss lessons learned.

2) Use & Non-Use of Decision Analysis in a Major Department of Energy Decision at Hanford, David A. Seaver, Battelle Pacific Northwest National Laboratory, PO Box 999, MS K8-03, Richland, WA 99352, david.seaver@pnl.gov, Andy Hesser, Mark Robershotte

In 1998, the DoE made a multi-billion dollar decision to authorize a privatized contract to process nuclear waste at Hanford. The decision, decision-analytic concepts used to structure the decision, some specific analyses and lessons learned regarding the application of decision analysis in a highly visible, political decision are discussed.

3) Selecting an Airport Vulnerability Assessment Methodology, Rick Lazarick, Federal Aviation Administration

We address the use of decision science methods in the evaluation and selection of a methodology for evaluating the vulnerability of airports to terrorist acts. The FAA and its assembled Blue Ribbon Panel rigorously employed the evaluation methods and reached a conclusive decision on the most desirable methodology.

4) Multi-Attribute Risk Analysis in Nuclear Emergency Management, Raimo P. Hamalainen, Helsinki University of Technology, Systems Analysis Lab., PO Box 1100, Espoo, 02015, Finland, raimo@hut.fi, Mats R. K. Lindstedt, Kari Sinkko

The Finnish radiation protection authorities practiced MAUT-based risk analysis in the early phase decisions on countermeasures after a simulated nuclear accident. The goal was to deal with conflicting objectives, different parties involved and uncertainties inherent in such crisis situations. This study was part of the EU-RODOS project.

5) Decision Analysis for Evaluating Environmental Regulation: Cautionary Tales, Rex Brown, George Mason University

Decision analysis attempts to evaluate the cost-benefit of proposed and past regulations realistically often run afoul of government and business politics. Examples and suggested remedies are drawn from consulting experience, including a Congressional mandate to EPA to determine if the Clear Air Act has been (or will be) worth its cost.

WA03 Logistics & Military Simulation

Sponsor: Military Applications Society
Sponsored Session

Chair: Mahyar Amouzegar, RAND Corp., 1700 Main St., Santa Monica, CA 90407, mahyar@rand.org

1) A Dynamic Distribution Model for Combat Logistics, Kevin R. Gue, Naval Postgraduate School, Dept. of Systems Mgmt., Monterey, CA 93943, krgue@nps.navy.mil, web.nps.navy.mil/~krgue

New warfare doctrine for the Marine Corps emphasizes small, highly-mobile forces supported from the sea, rather than from large, land-based supply points. We show how to configure the land-based distribution system over time to support a given battle plan with minimum inventory.

2) System Effectiveness Analysis Simulation & the Vertical Slice Technique, Christopher G. Pernin, RAND Corporation, 1700 Main St., Santa Monica, CA 90407, perninc@rand.org, Louis R. Moore

SEAS is an entity-based, time-stepped, stochastic, multitemission-level model designed to help evaluate the military utility of airborne and space-based communications and ISR assets. We will focus on a series of experiments run using SEAS to examine the Battlefield Awareness or Indication and Warning mission and the Battlefield Interdiction mission...

3) A Vision for the Future of Agile Combat Support & Mobility Systems, Mahyar Amouzegar, RAND Corp., 1700 Main St., Santa Monica, CA 90407, mahyar@rand.org, Robert S. Tripp

Radical changes in international security will require corresponding changes in both force organizations and logistics support. We present a vision for the future of ACS and mobility systems and address options for meeting munitions, WRM, fuel, maintenance processes and other support resource requirements for the variety of potential and uncertain scenarios the Air Force may face in the future.

WA05 Scheduling II

Contributed Session

Chair: Edward C. Sewell, Southern Illinois University, Dept. of Math. & Stats., Edwardsville, IL 62026-1653, esewell@siue.edu

1) The Asymptotic Performance Ratio of an On-Line Algorithm for the Single Machine Scheduling with Release Dates, Cheng-Feng Chou, Northwestern University, Dept. of IE/MS, 2145 Sheridan Rd., Evanston, IL 60208, cfchou@nwu.edu, *Maurice Queyranne, David Simchi-Levi*

We analyzed the single machine total weighted completion time problem with release dates. We present an additive error bound on the cost of a schedule constructed by an on-line algorithm relative to an LP lower bound. This implies that the on-line algorithm is asymptotically optimal.

2) Single-Machine Scheduling to Minimize Total Processing Plus Weighted Flow Cost is NP-Hard, Guohua Wan, HKUST, Dept. of IE & EM, Clear Water Bay, Hong Kong, PR China, ieghwan@ust.hk, *Benjamin P.-C. Yen*

We discuss a single machine scheduling problem to minimize total-processing plus weighted flow cost. Vickson (1980) studied this problem and conjectured that it is NP-hard. We give a positive answer to this conjecture, showing that the problem is NP-hard.

3) Total Weighted Tardiness in a Single Machine with Sequence Dependent Setup Times, Yushin Hong, POSTECH IE, 2842 Avenet Ferr Rd., #201, Raleigh, NC 27606, yhong@eos.ncsu.edu, *Hyungwoo Park*

A single machine scheduling problem with sequence dependent setup times is studied to develop an efficient approach that minimizes the total weighted tardiness. A dynamic priority rule for a good initial solution and an intelligent search procedure are proposed. Numerical tests show that the proposed approach works quite satisfactorily.

4) An Operation Scheduling System for Parallel Assembly Lines in Shipbuilding, Jung Ryoul Son, Pusan National University, Dept. of IE, 30 Changjeon-Dong, Kumjeong-Ku, Pusan, 609-735, Korea, jrlson@hyowon.pusan.ac.kr, http://ims.pusan.ac.kr/~jrlson, *Kyu-Kab Cho, Hak Soo Mok*

We present an operation scheduling algorithm for minimizing makespan in parallel assembly lines in shipbuilding. The parallel assembly lines are employed in small- and medium-subassembly for block construction in the shipyard. In the operation scheduling problem for parallel assembly lines, job sequencing and assignment are essential issues. Heuristic and GA approaches are proposed for minimizing makespan...

5) New Properties of the Single Machine Total Tardiness Problem, Edward C. Sewell, Southern Illinois University, Dept. of Math. & Stats., Edwardsville, IL 62026-1653, esewell@siue.edu

We reduce the range of times in which a job can complete in an optimal schedule, extend Lawler's decomposition principle by permitting decomposition on jobs other than just the largest and reduce by a factor of n the time and space complexity of Lawler's dynamic program, which remains the only known pseudopolynomial algorithm for the problem.

WA07 Marketing I

Contributed Session

Chair: Zahid Y. Khairullah, St. Bonaventure University, School of Bus., Box Z, St. Bonaventure, NY 14778, zyk@sbu.edu

1) Forecasting Competitive Relations of Brands: A Bayesian Approach, Nobuhiko Terui, Tohoku University, Fac. of Economics, Kawauchi Aoba-ku, Sendai, Miyagi, 980 8576, Japan, terui@econ.tohoku.ac.jp

In terms of joint prediction distribution, based on a Bayesian multivariate time series model, I discuss a statistical inference on the complicated dynamic relations of future sales volumes and future market shares across competitive brands.

2) The Hockey Stick Explained: A Random Graph Model of New Product Adoptions, Morgan Jones, University of North Carolina, Kenan-Flagler Bus. School, Chapel Hill, NC 27599-3490, morgan_jones@unc.edu

Random graphs have properties which make them appealing to consider as models of new product adoptions. They represent a growing network, such as word-of-mouth, and their pattern of evolution is like that of adoptions of new products - a long period of slow growth followed by a sudden increase.

3) The Use of Projective Technique to Study Socio-Economic & Demographic Characteristics of Asian Indians, Zahid Y. Khairullah, St. Bonaventure University, School of Bus., Box Z, St. Bonaventure, NY 14778, zyk@sbu.edu, *Durriya Z. Khairullah*

We explore the perceptions of Asian-Indian immigrants in terms of the respondents' own needs, values and demographic characteristics. How the

respondents felt and reacted to Indian and American magazine advertisements is discussed.

WA08 Stochastic Models

Sponsor: Applied Probability Society

Sponsored Session

Chair: Shaohui Zheng, HKUST, Dept. of ISMT, Clear Water Bay, Kowloon, Hong Kong, imzheng@ust.hk

1) Performance Analysis of a Distributed Supply Network under Alternative Allocation Policies, Liwei Bai, HKUST, Dept. of IEEM, Clear Water Bay, Kowloon, Hong Kong, bailw@ust.hk, *Liming Liu*

We compare 2 alternative allocation policies, FCFS and longest-queue-first (LQF) in a 2-stage distributed supply system. An effective approximation scheme is developed and tested for the performance analysis of the system under the LQF discipline. Some managerial insights into allocation policy selection are obtained.

2) State-Dependent Coupling of Non-Quasi-Reversible Nodes, Xiuli Chao, NJIT, Dept. of IME, University Heights, Newark, NJ 07102, *Bill Henderson, Peter Taylor*

We start with a queueing network where the transition rate at each node depends only on the state of the node information. Assuming the network has a stationary distribution, we obtain a general network with state-dependent transition rates that has a tractable stationary distribution. This result extends several recent papers on state-dependent coupling of quasi-reversible nodes.

3) An Existence Condition for the Diffusion Approximations of Priority Multiclass Queueing Networks, Hong Chen, University of British Columbia, Fac. of Commerce, Dept. of IE, *Hengqing Ye*

We present a new sufficient condition for the existence of the (conventional) diffusion approximation for multiclass queueing networks under priority service disciplines. This sufficient condition relates to the weak stability and the stability of the high priority classes of the fluid networks that correspond to the queueing networks...

4) Dynamic Release Policies for Software Systems with Reliability Constraints, Shaohui Zheng, HKUST, Dept. of ISMT, Clear Water Bay, Kowloon, Hong Kong, imzheng@ust.hk

We discuss the release problem of computer software with reliability constraints. A conditional non-homogeneous Poisson process model is used to describe the software reliability growth behavior. By formulating with Markov decision programming, we show that to minimize total discounted cost, the optimal release policy is threshold-type. Heuristic policy is also discussed.

WA10 Production & Scheduling III

Contributed Session

Chair: Byoung Sung Ko, Pusan National University, Dept. of IE, Pusan, 609-735, Korea, kbsgo@hyowon.pusan.ac.kr

1) New Models for Efficiency-Based Production Planning & Control, Krishna Kumar, Indian Institute of Technology, IBM India Research Lab., Block 1, IIT Delhi, Hauz Khas, New Delhi, 110 016, India, ckkumar@mailcity.com, *Bani Sinha*

Efficiency-based production planning and control models are presented as an alternate paradigm applicable in manufacturing situations where cost of inputs and outputs cannot be reliably determined, thus rendering traditional models inapplicable. Characterization of the efficient plans and numerical comparison with existing approaches are also presented.

2) Value Management for Manufacturing: Adaptation of Airline Yield Management Techniques to Manufacturing Decision Support, Vibhu Kalyan, i2 Technologies, 909 East Las Colinas Blvd., 16th Fl., Irving, TX 75039, vibhu_kalyan@i2.com

Airlines have perfected yield management to tap billions in additional profits by properly valuing their resource: airline seats. We show how similar concepts can help manufacturers value their manufacturing resources and wean them away from traditional ways of meeting demand; namely, if you can build it, sell it.

3) A Modified Doubling-Up Algorithm for the Traveling Salesman Problem, Bongryong Jung, Hanyang University, Dept. of IE, Sa 1 Dong, Ansan, Kyunggi, 425-791, Korea, brjung@mecors.hanyang.ac.kr

We present a modified doubling-up algorithm for the TSP based on dynamic programming. The main difference between our model and previous models is that we are concentrating the most promising subpath from the initial stage in order to decrease the computational effort. It can be applied in another TSP version but also offers much flexibility in taking advantage of special structures.

4) An EOQ Model for Ameliorating & Deteriorating Items with Time-Varying Demand under Inflation & Time Discounting, Ilkyeong Moon, Pusan National University, Dept. of IE, Pusan, 609-735, Korea, ikmoon@hyowon.pusan.ac.kr, http://www.ie.pusan.ac.kr, *Byoung Sung Ko*

Bose, Goswami & Chaudhuri considered the inventory replenishment problem for a deteriorating item with linearly time-varying demand under inflation and time discounting. The analysis, however, contained mathematical errors for modeling the inventory holding costs. We propose the correct model and allow an ameliorating item as well as a deteriorating item at the same time.

WA11 Statistics & Quality Control I
Contributed Session

Chair: Claude R. Superville, Valdosta State University, Coll. of Bus. Admin., 1500 North Patterson St., Valdosta, GA 31698-0076, csupervi@valdosta.edu

1) The Value of Scoring in North American Football, Keith Willoughby, Bucknell University, Dept. of Mgmt., Lewisburg, PA 17837, kwiloug@bucknell.edu

North American football features a scoring system whereby one score does not equal one point. Using results from the 1998 and 1999 regular seasons, we develop a linear regression model to explore the benefits of various scoring plays.

2) Efficient Computation of the Two-Sample Randomization Distribution, James P. Jarvis, Clemson University, Martin Hall, Clemson, SC 29634-1907, jppjr@clemson.edu, *Marie Coffin, Douglas Robert Shier*

The randomization distribution is used to compare the means of 2 groups when equal one point. Using results from the 1998 and 1999 regular seasons, we develop a linear regression model to explore the benefits of various scoring plays.

3) Using Genetic Algorithms to Solve Quality Control Optimization Problems, Sanford K. Cohn, Richard Stockton College, Jimmie Leeds Rd., Pomona, NJ 08240, cohns@stockton.edu

We develop a generic dynamic programming formulation that can be used to model many practical QC optimization problems. We then use a commercially available metaheuristic spreadsheet add-in to obtain near optimal solutions to this problem. This model is then applied to a wide variety of different QC situations.

4) Monitoring Short Autocorrelated Production Runs: A Case Study, Claude R. Superville, Valdosta State University, Coll. of Bus. Admin., 1500 North Patterson St., Valdosta, GA 31698-0076, csupervi@valdosta.edu

A problem that occurs in monitoring short production runs is an insufficient amount of data to adequately estimate process parameters for control chart construction. The Q chart and sequential X-chart have been proposed as alternatives to traditional control charts for such situations. A case study examines the application of a Q chart and a sequential X-chart...

WA12 Network Models in Air Transportation

Cluster: Networks

Sponsor: Optimization Section
Sponsored Session

Chair: Michael O. Ball, University of Maryland, Smith Sch. of Business, Inst. for Systems Research, College Park, MD 20742-1815, mball@rhsmith.umd.edu

1) Multiple Fleet Aircraft Schedule Recovery following Hub Closures, Benjamin G. Thengvall, University of Texas, Grad. Program in OR, Dept. of Mech. Eng., Austin, TX 78712-1063, benji@mail.utexas.edu, *Jonathan F. Bard, Gang Yu*

Three multi-commodity network-type models are presented for determining a recovery schedule for all aircraft operated by a large carrier following a hub closure. Each allows for cancellations, delays, ferry flights and substitution between fleets and subfleets. Different objectives are explored. Analysis of the models are conducted and compared. Results for a comprehensive set of scenarios and ideas for continuing work are shown.

2) Airline Scheduling Planning, Cynthia Barnhart, MIT, Rm. 1-229, Cambridge, MA 02139, cbarnhar@mit.edu, *Andrew P. Armacost, Amr Farahat, Manoj Lohatepanont*

We consider the process of airline schedule planning where the ultimate objective is to determine the profit maximizing flight schedule given a fixed

fleet of aircraft and passenger demands. The flight schedule specifies the flight legs to be flown and associated scheduled departure times. We pose alternative models and algorithms for scheduling planning...

3) The Rate Control Index for Traffic Flow, Michael O. Ball, University of Maryland, Smith Sch. of Business, Inst. for Systems Research, College Park, MD 20742-1815, mball@rhsmith.umd.edu, *Robert L. Hoffman*

We introduce a single-valued metric for post-operatively rating the performance of achieved traffic flow against a targeted traffic flow. This metric was developed to rate the performance of ground delay programs, which are air traffic flow management initiatives. The development of this metric involves the analysis of network flow solutions over a simple linear network.

WA16 Dynamic Traffic Assignment

Sponsor: Transportation Science Section
Sponsored Session

Chair: Athanasios Ziliaskopoulos, Northwestern University, Dept. of Civil Eng., 2145 Sheridan Rd., Tech. Inst., Evanston, IL 60208, a-z@nwu.edu

1) Stability Analysis of On-Line Route Guidance using a Dynamic Systems Framework, Srinivas Peeta, Purdue University, Sch. of Civil Eng., 1284 Civil Eng. Bldg., West Lafayette, IN 47907-1284, *Ta-Hui Yang*

The on-line DTA problem is addressed using a dynamical systems framework. Stability analysis is explored for well-known traffic assignment rules. Insights from the theoretical investigation are discussed.

2) A Hybrid GA-ANN Model of Tripmaker Learning & Adjustments for the Dynamic Traffic Assignment, Peter Chen, University of Illinois, Dept. of Civil & Environ. Eng., 1213 Newmark Civil Eng. Lab., Urbana, IL 61801, pschen@uiuc.edu, *Chi-Hua Chang*

An AI-based predictive model has been developed for tripmaker route and departure time decisions under real-time information, representing learning and adjustment processes for within-day and day-to-day dynamics. This model can be viewed as an adaptive agent in an agent-based system aimed at predicting individual driver decisions in a DTA simulation framework.

3) Representing Spillover in Analytical Dynamic Traffic Assignment Models, Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu, *Shan Lan*

We show models that represent spillover of queues, a phenomenon common in congested traffic networks. The models and solution algorithms are based on analytical formulations and algorithms developed by Chabini & He (1997) for the dynamic network loading problem. The models are analyzed theoretically. We illustrate the properties of the models for a small network example...

4) A Combinatoric Algorithm for the Single-Destination User-Optimal Dynamic Traffic Assignment, S. Travis Waller, Northwestern University, Dept. of Civ. Eng., 2145 Sheridan Rd., Tech. Inst., Evanston, IL 60208, travis@trans.civil.nwu.edu, *Athanasios Ziliaskopoulos*

An efficient combinatoric network algorithm is presented for the single-destination dynamic traffic assignment problem when user-optimal routes are followed. The algorithm is based on the time-space expansion of a network as represented by the cell transmission theory for traffic flow. Algorithm design, properties and computational complexities will be presented.

WA17 Airline Applications

Contributed Session

Chair: Ladislav Letovsky, Sabre Inc., Research Group, 1 East Kirkwood Bldg., MD 7310, Southlake, TX 76092, ladislav@sabre.com

1) An On-Line Tool for On-Time Performance of Flight Operations, Gurcan Bicken, United Airlines WHQKB, 1200 Algonquin Rd., Elk Grove, IL 60007, gurcan.bicken@ual.com, *Ming Xi, Baoxing Tang*

A fast statistical algorithm was developed to estimate the on-time performances of scheduled flights. With the present algorithm, on-time performances of 2,000 scheduled flights can be computed up to the theoretical accuracy within one second. We compare the results and computational performances of both simulation and statistical methods.

2) Landing of Airplanes (Continuous Time), Lakatos Laszlo, Eotvos Lorand University, POB 32, Budapest, H-1518, Hungary, lakatos@compalg.inf.elte.hu

Considering the landing airplanes, we investigate a queueing system with Poisson arrivals and exponentially and uniformly distributed service time. The special feature is that the service can be started upon arrival or at moments differing by the multiples of cycle time which is necessary to make a circle in case of waiting.

3) Schedule Generation, Ladislav Lettovsky, Sabre Inc., Research Group, 1 East Kirkwood Bldg., MD 7310, Southlake, TX 76092, ladislav@sabre.com, **Ellis L. Johnson, Barry C. Smith**

We present a new optimization-based approach for schedule design. The framework allows users to improve an existing airline schedule or to generate a new schedule from scratch with profitable schedule changes, i.e., additional routes, frequency modifications, timing adjustments, capacity reassignments, etc. The tool uses a market-share model to capture competitive forces from other airlines...

WA19 Resource Modeling

Contributed Session

Chair: Jiaqin Yang, Mgmt. Dept., Box 11, Milledgeville, GA, jyang@mail.gcsu.edu

1) Agricultural Risk & its Dynamics: A New Look into Farmers' Participation, Shiva Makki, ERS/USDA, 1800 M St. NW, Rm. S5007, Washington, DC 20036, smakki@econ.ag.gov, **Agapi L. Somwaru**

We analyze factors that influence a farmer's decision to participate or not to participate in agricultural risk insurance programs using the neural networks method. Preliminary analysis indicates that the demand for insurance products differs distinctively across commodities and regions. Results indicate that geo-demographic factors significantly influence farmers' participation in the program.

2) Spatial Analysis Methods to Determine Optimal Siting of Added Used Oil Recycling Locations in Western Riverside County, California, Alan Crouse, Western Riverside Council of Governments, Riverside, CA, crouse@wrcog.cog.ca.us, **James B. Pick**

Multivariate spatial statistical analysis is applied to determine which demographic and geographic attributes are associated with high levels of used motor oil recycling in Riverside County's recycling program. GIS techniques are developed and applied to select 11 high priority locations for additional used motor oil collection centers in the region.

3) Modeling & Optimization of an Oil/Dehydration Desalting System, Musleh Al-Otaibi, University of Kuwait, Dept. of Chemical Eng., PO Box 5969, Safat, 13060, Kuwait, aloataibi@kuc01.kuniv.edu.kw, **Ali Elkamel, Taher Al-Sahhaf**

Dehydration/desalting facilities are often installed in crude oil production operations in order to minimize the occurrence of water-in-oil emulsions. The desalting process involves 6 major steps: separation by gravity settling, chemical injection, heating, addition of less salty water (dilution), mixing and electric coalescing. An ANN that models the desalting process is presented...

4) Bioeconomic Returns under Uncertainty for Short Rotation Woody Species, Peter Linehan, University of Florida, Sch. of Forestry/Conservation, PO Box 3634, Milton, FL 32572-3634, pel@gnv.ifas.ufl.edu, **Douglas R. Carter, Frank D. Merry**

A spreadsheet-based simulation model is used to evaluate the optimum rotation length for short rotation forest plantations in Florida. Variables include the biological production function, production costs and estimated product prices. The tradeoff between the biological and financial optimums is also determined.

5) Optimal Resource Allocation: A Model for Technology Advancement in Developing Countries, Jiaqin Yang, Mgmt. Dept., Box 11, Milledgeville, GA, jyang@mail.gcsu.edu, **Ping Shi**

A specific model for measuring the technology advancement through a more efficient resource allocation is presented. To validate the model, data from the last 40 years from an inner province of China were collected and tested. The results show that the level of technology advancement was 40% below the national average...

WA20 Queueing & Inventory I

Contributed Session

Chair: Timothy L. Urban, University of Tulsa, 600 South College Ave., College of Bus. Admin., Tulsa, OK 74012, urbantl@utulsa.edu, http://www.cba.utulsa.edu/qm_tlu/

1) An Analysis of the Min (N,T) M/G/1 Queueing System, Sun Hur, Hanyan University, Dept. of IE, Sa 1 Dong, Ansan, Kyounggi-Do, 425-791, Korea, hursun@email.hanyang.ac.kr, http://metropol.

hanyang.ac.kr, **Hun-Gyu Lee**

We consider a M/G/1 vacation system. The server becomes active either when there are at least a predetermined number of customers or at least one customer when he comes back from his fixed time vacation. A best control policy is investigated for given cost structure. Numerical tests are given.

2) Development of Creativity & Innovation in Entrepreneurship of the Hotel Industry in Europe, Ivan Vukovic, Faculty of Hotel Management, Ika 42, Opatija, 51410, Croatia, **Korina Pezelj**

This work is based on the research of creativity and innovation in the entrepreneurship in the hotel industry of Europe. We define creativity and innovation in the hotel industry of Europe and research a particularity of the hotel industry as well as main characteristics of creativity and innovation development in different types of entrepreneurship in Europe...

3) On Distribution-Free Optimization Procedures for some Inventory-Related Models, Jinfeng Yue, Washington State University, Dept. of Mgmt. & Dec. Science, Coll. of Bus. & Economics, Pullman, WA 99164, yuej@wsunix.wsu.edu, **Bintong Chen, Min-Chiang Wang**

We discuss distribution-free optimization procedures for some inventory-related models with limited distribution information. We obtain several tight bounds for both objectives and decision variables. The distribution-free robust solutions, which we believe can be used in many areas, are proposed and analyzed.

4) Inventory & Pricing Policies for Dated Products, Timothy L. Urban, University of Tulsa, 600 South College Ave., College of Bus. Admin., Tulsa, OK 74012, urbantl@utulsa.edu, http://www.cba.utulsa.edu/qm_tlu/, **Rashid G. Kiwanuka**

Inventory management and pricing policies for products with expiration dates are investigated. Product demand is assumed to be sensitive to the time remaining to expiration as well as price. The basic model is extended to the clearance situation in which the retailer marks down the price of short-dated product when fresh product arrives.

5) withdrawn - author request of 4/7, Graeme M. Warren, Purdue University, 1142 Cherry Ln, West Lafayette, IN 47906, graeme@gilbreth.ecn.purdue.edu

WA25 Information Systems III

Contributed Session

Chair: Ziqi Liao, Hong Kong Baptist University, FDS, Kowloon Tong, Hong Kong, Hong Kong China, zqliao@yahoo.com

1) Measuring the Value of Internet Commerce to the Customer, Reza Torkzadeh, University of Nevada, 4505 Maryland Parkway, Box 456009, Las Vegas, NV 89154, torkz@ccmail.nevada.edu, **Gurpreet Dhillon**

We present findings of the survey used to evaluate the value of Internet commerce based upon customer perceptions compared to purchases by conventional methods such as mail order. The survey asks questions concerning the value of Internet commerce for the customers based on experience or perception...

2) Solving the Project Time-Cost Trade-Off Problem through an Integrated Engineering-Computation Environment, Han P. Bao, Old Dominion University, Dept. of Mech. Eng., 238 Kaufman Hall, Norfolk, VA 23529, bao@mem.odu.edu, http://mem.odu.edu/~bao/, **Hisham M. AbdelSalam**

The time-cost trade-off problem in project networks has been solved by several methods, starting with enumerative methods and ending with AI. We implement an LP formulation to solve this problem through a truly interactive computation environment based on a state-of-the-art object-oriented database management system.

3) Correlation between Object-Oriented Databases & Supply Chain Business Operations, Apurba K. Saha, Aspen Technology, 200 South St., New Providence, NJ 07974, apurba.saha@aspentech.com

We investigate requirements for frameworks, built-in models and knowledge-bases in today's software applications in SCBOs. Scheduling operation and what-if models have been analyzed in detail. In search of a suitable supporting database, it has been shown how features of object-oriented databases such as meta-data, persistence and object-relationships can be easily used to support the requirements of SCBO applications.

4) How to Document a Spreadsheet, Jane N. Hagstrom, University of Illinois, Dept. of Info. & Dec. Sci., 601 South Morgan, MC 294, Chicago, IL 60607, hagstrom@uic.edu

In taking advantage of the great analytical power available in modern

spreadsheet packages, we are forced to confront the problem of verifying our model. Layout, labeling and color-coding can be used to make the verification problem manageable. The approach presented also allows straightforward investigation of whether a model is linear.

5) A Multi-Dimensional Model to Evaluate Information Systems Investment, Ziqi Liao, Hong Kong Baptist University, FDS, Kowloon Tong, Hong Kong, Hong Kong China, zqliao@yahoo.com

A multi-dimensional decision model is developed to facilitate the selection of appropriate assessment techniques for the investment analysis of ISs at various stages of the life cycle of technology. Empirical studies have been conducted in the IT departments of 3 commercial banks and we present the results.

WA27 Cost Performance Analysis

Contributed Session

Chair: Cuauhtemoc Olmedo-Bustillo, ITESM Toluca, Av. Eduardo Monroy Cardenas, Toluca, 50110, Mexico, colmedo@campus.tol.itesm.mx

1) Measuring & Improving Efficiency in a Government Organization, Diana I. Angelis, Naval Postgraduate School, 1522 Cunningham Rd., Monterey, CA 93943, diangelis@nps.navy.mil

The first step towards improving efficiency in a government organization is to measure the cost of outputs. We examine the efforts of the Defense Contract Management Command to measure their efficiency through unit cost and discuss some challenges in using this information to improve their processes, efficiency and performance as they move from cost measurement to activity-based management.

2) Quality Improvement of CMP Processes in Semiconductor Manufacturing using a Combined Response Surface Methodology-NLP Approach, Shu-Kai S. Fan, Mingchi Institute of Technology, No. 84 Gungjuan Rd., Taishan, Taipei County, 243, Taiwan, ROC, simonfan@ccsun.mit.edu.tw, www.iem.mit.edu.tw/~simonfan

We focus on how to develop and utilize a specialized response surface method combined with state-of-the-art mathematical programming techniques for quality improvements of the chemical-mechanical planarization (CMP) process in semiconductor manufacturing. CMP is one of the fastest growing technologies that enables us to polish the topography of interlayer dielectrics...

3) A Quality Plan for Adhesive Tape Production, Thanakorn Kiablanue, King Mongkut's Institute of Technology, Fac. of Eng., Dept. Prod. Tech, 1518 Pibulsongkram Rd., Bangkok, 10800, Thailand, tkl@kmitnb.ac.th

We introduce an effective quality plan according to ISO9002: 1994 for adhesive tape production. The study develops a quality flow process chart from raw material storages to finished product stocks. An example of the implementation and benefits are also presented. This quality plan plays an important role in improving customer satisfaction and as a foundation for quality management system certification.

4) Increasing Fairness in Home Mortgage Assistance from the Rural Housing Service, Richard M. Soland, George Washington University, Dept. of EMSE, School of Eng., Washington, DC 20052, soland@seas.gwu.edu, *Rompissri Noichaiboon, Jirachai Thaichart*

The RHS subsidizes home mortgage loans made to low-income families. The subsidy amount is a function of adjusted annual income (AAI) and some families have seen substantial decreases in their subsidies due to small increases in AAI. We examine the reasons for this and suggest some possible remedies.

5) Perceptions of the Impact of Cultural Factors in TQM Implementation in Mexico: An Empirical Study & Some Guidelines, Cuauhtemoc Olmedo-Bustillo, ITESM Toluca, Av. Eduardo Monroy Cardenas, Toluca, 50110, Mexico, colmedo@campus.tol.itesm.mx, *Martin Llanos-Plata*

Successful TQM implementation requires a particular attitudinal profile in people. The community's culture shapes this profile and may work against the desired profile for TQM implementation. We explore some relevant cultural elements in Mexican industry and propose guidelines for the alignment of TQM implementation design and culture driven attitudes.

WA28 Cutting Plane Approaches to Mixed Integer Programs

Cluster: Computational Mixed Integer Programming
Invited Session

Chair: Ismael R. de Farias, Jr., SUNY, Dept. of IE, 403 Bell Hall, Buffalo, NY 14260-2050, defarias@buffalo.edu

1) Network Flow with Integer Variable Upper Bounds, Diego Klabjan, University of Illinois, Dept. of MIE, Urbana, IL 61801,

George L. Nemhauser

We present a polyhedral study of a 1-node network flow model with integer variable upper bounds. Valid inequalities are presented that are lifted to facets using sequence independent lifting.

2) A Column Generation, Cut & Bounding Approach to the Bandwidth Problem, Christine Villa, BRTRC, 8260 Willow Oaks Corp. Dr., Ste. 800, Fairfax, VA 22031, cvilla@brtrc.com, *Karla Hoffman*

We take a column-bound-cut approach to optically solve the band packing problem arising from telecommunication networks. The LP relaxation of an IP formulation is solved using column generation, an LP-based heuristic and strong cutting planes.

3) Computational Experiments on the use of Two Families of Inequalities Valid for the Generalized Assignment Polytope, Ismael R. de Farias, Jr., SUNY, Dept. of IE, 403 Bell Hall, Buffalo, NY 14260-2050, defarias@buffalo.edu, *George L. Nemhauser*

We derive 2 families of inequalities valid for the generalized assignment polytope. Although the inequalities are not facet-defining in general, they define facets of a polytope related to a close relaxation. We show how the inequalities can be separated and report computational results that demonstrate their effectiveness.

WA32 Solving Large-Scale Spreadsheet Optimization Models in EXCEL with the MPL Modeling System

Sponsor: Computing Society
Sponsored Session

Chair: Mark Webster, Maximal Software, Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201, mark@maximal-usa.com, www.maximal-usa.com

1) Solving Large-Scale Spreadsheet Optimization Models in EXCEL with the MPL Modeling System, Mark Webster, Maximal Software, Inc., 2111 Wilson Blvd., Ste. 700, Arlington, VA 22201, mark@maximal-usa.com, www.maximal-usa.com, *Bjarni Kristjansson*

MPL recently added the ability to read/write EXCEL spreadsheets directly. This new feature allows the spreadsheet to be open while optimizing and easily handles dense 2-dimensional data and single scalar values. Along with the VBA support of OptiMax 2000, this allows the modeler to create EXCEL optimization applications without any size limits.

WA33 Queueing Systems with Flexible Servers

Cluster: Queues
Invited Session

Chair: Doug Down, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332, ddown@isye.gatech.edu

Co-Chair: Hayriye Ayhan, Georgia Institute of Technology, Sch. of ISYE, Atlanta, GA 30332-0205, hayhan@isye.gatech.edu

1) Worker Flexibility in CONWIP Controlled Assembly Systems, Siggí Olafsson, Iowa State University, Dept. of IMSE, 2019 Black Engineering Bldg., Ames, IA 50011-2164, olafsson@iastate.edu, *Sameh Al-Shihabi*

We investigate issues related to the use of multi-skilled workers in assembly systems subject to CONWIP control. Using both queueing and simulation models, we demonstrate how the capability of moving workers from one station to another can significantly reduce the WIP needed to obtain a given throughput. We also discuss control policies that may be applied for worker assignment.

2) Classification & Modeling of Production Systems using Cross-Trained Workers, Mark P. Van Oyen, Loyola University, ISOM Dept., 25 East Pearson St., Chicago, IL 60611, mvanoye@luc.edu, vanoyen@iems.nwu.edu, *Wallace J. Hopp*

We classify production and service operations based on their potential use of cross-trained workers. We identify key factors of various environments to address the following questions: Which systems offer significant potential for the use of cross-trained workers? How can cross-trained workers be organized to maximize performance opportunity?

3) Optimal Stochastic Scheduling of a 2-Stage Tandem Queue with Parallel Servers, Hyun-Soo Ahn, University of Michigan, Dept. of IOE, 1205 Beal Ave., Ann Arbor, MI 48109-2117, hsaahn@engin.

umich.edu, *Izak Duenyas, Rachel Q. Zhang*

We consider the optimal stochastic scheduling of a 2-stage tandem queue with 2 parallel servers. The servers can serve either queue at any time to minimize the total holding costs incurred until all jobs leave the system. We characterize sufficient and necessary conditions under which it is optimal to allocate both servers to the upstream or downstream queue.

4) Server Assignment Policies for Finite Buffer Queues in Series, Sigrun Andradottir, Georgia Institute of Technology, Sch. of ISyE, Atlanta, GA 30332-0205, sandradottir@isye.gatech.edu, *Hayriye Ayhan, Doug Down*

We consider a queueing system with n stations in series and flexible servers. The objective is to determine the optimal allocation and cooperation policy of the flexible servers to maximize the long run average throughput. After characterizing the optimal policy for the 2-station case, we develop heuristics for system with more than 2 stations.

Wednesday 10:15-11:45

WB01 DA 2000 & Beyond: How Industry is Learning & Applying Decision Analysis

Sponsor: Decision Analysis Society
Sponsored Session

Chair: David C. Skinner, Decision Strategies, Inc., 13410 Queensbury Lane, Houston, TX 77079, skinnerdc@aol.com

1) Decision Analysis in the 21st Century: Integrated Decision Management, James McCuish, BP/Amoco, 3700 Bay Area Blvd., Houston, TX 77058

Integrated Decision Management enhances decision analysis and real options methodologies by actively linking them into the organization's systems and cultures for value engineering, project management and capital portfolio optimization. Ignoring this often creates an "orphan status" for decision analysis that does not deliver timely results or long-term value.

2) Decision Analysis in the 21st Century: Integrated Portfolio Management, Gerald A. Bush, Decision Strategies, Inc., Atlanta, GA 30350, gabush@decisionstrategies.com

The drive for value and R&D efficiency has led to new thinking about the principles and methods for evaluating pharmaceutical projects using probabilistic discounted cash flow and real options methods. Integrated Portfolio Management incorporates the best practices and software automation into a modern system for today's leading companies.

3) Decision Analysis in the 21st Century: Pharmaceutical Portfolio, Cynthia S. Sushak, Novartis Pharmaceuticals, 59 Route 10, Bldg. 122/336, East Hanover, NJ 07936, synthia.sushak@pharma.novartis.com

The application of Integrated Portfolio Management to a pharmaceutical portfolio led to a significant R&D savings and enhanced understanding of each project's potential and risk. The approach used probabilistic cash flow and real options methods to appropriately value each type of project. Portfolio Wizard software enabled quick optimization and display of scenarios.

4) Decision Analysis in the 21st Century: Multimedia Training, David C. Skinner, Decision Strategies, Inc., 13410 Queensbury Ln, Houston, TX 77079, skinnerdc@aol.com

A series of hands-on workshops combined with Internet-based tutorials are available to learn Integrated Decision Management. The spectrum of concepts and skills ranges from the fundamentals for general audiences to advanced topics for practitioners. Innovative use of multimedia technology adds depth and individual flexibility to the learning process.

WB03 RAHMORS Contributed

Sponsor: Military Applications Society
Sponsored Session

Chair: Bruce W. Fowler, US Army Aviation Missile Command, ATTN: AMSAM-RD-AS, Redstone Arsenal, AL 35898-5242, bw@redstone.army.mil

1) Unintended Targets: Prelude to Fratricide, John P. Ballenger, Raytheon Systems Company, 353 James Record Rd., Huntsville, AL 35824, jp_ballenger@raytheon.com

This study is a continuation of "Fratricide on the Modern Battlefield," which examined the information component and the physical component of fratricide. The current study focuses on the relationship between errors associated with factors in each component and the probability of fratricide and provides an underpinning for a fratricide model.

2) A Fast Algorithm for Formal Aggregation, Bruce W. Fowler, US Army Aviation Missile Command, ATTN: AMSAM-RD-AS, Redstone Arsenal, AL 35898-5242, bw@redstone.army.mil

We present partial formal aggregation of a Lanchester heterogeneous problem to a reduced, smaller problem. Using this as a basis, we develop an algorithm of sequential aggregation the heterogeneous problem to the homogeneous problem. These aggregations are 2+1 and 1+2 aggregations that may be performed using analytical expressions. Consequently, calculation of the $N+M$ eigenvectors and eigenvalues is avoided...

3) Exploring the Milgram Experiments, John P. Ballenger, Raytheon Systems Company, 353 James Record Rd., Huntsville, AL 35824, jp_ballenger@raytheon.com, *Bruce W. Fowler*

The Milgram experiments explored the psychological nature of violent acts. The context was that of an individual actor, a leader and a peer group. This is a microcosm of military action in combat. We examine the construction of a model based on the results of these experiments.

WB05 Scheduling 3

Contributed Session

Chair: Grisselle Centeno, University of Central Florida, PO Box 162450, Orlando, FL 32816-2450, gcenteno@pegasus.cc.ucf.edu, ie.engr.ucf.edu/faculty/centeno/home/htm

1) Scheduling Production Systems with Serial Stages, Alejandro Garcia del Valle, Department of Economic Analysis, Mendizabal s/n, Ferrol, La Coruna, 15403, Spain, agvalle@udc.es, http://pc-agvalle.eps.cdf.udc.es/, *Javier Faulin*

We describe a method for obtaining a coordinated production schedule for a multilevel production system with serial stages. The objective is to minimize the total average cost. Several items are produced in each stage. Schedules for contiguous stages are coordinated. The method always obtains a feasible schedule.

2) A Heuristic for Minimizing Total Weighted Tardiness on the Identical Parallel Machine Scheduling Problem with Family Setup Times, Hyun-Jun Shin, Korea University, Anamdong 5th St., Seoul, 136 701, Korea, mrshin@kucenx.korea.ac.kr, *SungSchick Kim*

We propose a 2-phase heuristic for the problem of minimizing the total weighted tardiness on identical parallel machines in the presence of family setup times. In the first phase, jobs are grouped into a number of family groups according to their family type and the family groups are sequenced...

3) An Approximation Algorithm for Parallel Machine Scheduling with a Common Server, Guoqing Wang, Hong Kong Polytechnic University, Dept. of Mgmt., Hong Kong, PR China, msgqwang@polyu.edu.hk, *Edwin Cheng*

We study the scheduling of a given set of jobs on several identical parallel machines tended by a common server. The objective is to schedule the jobs to minimize the total weighted job completion times. We provide an approximation algorithm to tackle this intractable problem and analyze the worst-case performance of the algorithm for the general as well as a special case of the problem.

4) Parallel Machine Scheduling with Specified Release Dates, Due Dates & Machine Eligibility Restriction, Grisselle Centeno, University of Central Florida, PO Box 162450, Orlando, FL 32816-2450, gcenteno@pegasus.cc.ucf.edu, ie.engr.ucf.edu/faculty/centeno/home/htm, *Robert L. Armacost*

Effective heuristic algorithms using composite dispatching rules have been developed with the objective of minimizing maximum lateness. Algorithms integrate rules for job selection as well as for machine selection and degrees of nesting for the machine eligibility restriction. Heuristics have been evaluated using real data from the semiconductor industry.

WB07 Marketing II

Contributed Session

Chair: Durriya Z. Khairullah, St. Bonaventure University, School of Bus., Box Z, St. Bonaventure, NY 14778, durzk@sbu.edu

1) Price Wars & their Implications: The Finnish Gasoline Retail Market, Minna Mattila, University of Jyväskylä, Sch. of Bus. & Economics, PO Box 35 (MaE), Jyväskylä, 40351, Finland, mimaja@tase.jyu.fi

Game-theory and laws from economics have been used in building the optimal price war reaction model presented. Oil companies save millions of dollars annually if they save a nickle per gallon sold. Sales quantity and daily prices

form the data against which the model will be reflected.

2) Scheduling of Promotions using Market Structure Analysis & Network Optimization, Dmitry Krass, University of Toronto, Rotman Sch. of Mgmt., 105 Saint George St., Toronto, Ontario, M5S 3E6, Canada, krass@mgmt.utoronto.ca, **Iosif A. Krass**

The problem consists of constructing a promotional schedule for a given set of products to maximize expected sales while achieving required consumer penetration levels. We use market structure analysis to identify consumer segments and then apply network optimization techniques to construct promotion schedules over various time horizons.

3) Price-Setting in Direct & Retail to Customer Supply Channels, Wei-yu Chiang, University of Illinois, 350 Commerce West, 1206 South 6th St., Champaign, IL 61820, wchiang@uiuc.edu, **Dilip Chhajed**

A parsimonious model is developed to conceptualize the impact of customer acceptance of buying through the direct channel on the price-setting game between the manufacturer engaging in the direct sale and its profit-maximizing retail partners. We also explore the mechanism of channel coordination under the supply chain system.

4) Content Analysis: US & Indian Advertisements, Durriya Z. Khairullah, St. Bonaventure University, School of Bus., Box Z, St. Bonaventure, NY 14778, durzk@sbu.edu, **Zahid Y. Khairullah**

We examine similarities and differences in the cultural values depicted in advertisements in popular magazines in the US and India. The background literature on content analysis and implications of the study are discussed.

WB08 Stochastic Modeling

Contributed Session

Chair: Joshua Levy, University of Central Oklahoma, Dept. of Math. & Stats., 100 North University Dr., Edmond, OK 73034, jlevy@aix1.ucok.edu

1) withdrawn - author request of 3/30, Shau-Shiang Ja, SABRE Technology Solutions, 1 East Kirkwood Blvd., MD 7300, Southlake, TX 76092, shau-shiang_je@sabre.com, **Vidyadhar G. Kulkarni, Amitava Mitra, Jayprakash G. Patankar**

2) Markov Chain Monte Carlo for Combinatorial Auctions, Kannan Balaji, Indian Institute of Technology, IBM India Research Lab., Block I, Hauz Khas, New Delhi, 110 016, India, kbalaji@in.ibm.com, **Abhinanda Sarkar**

Winner determination in combinatorial auctions is computationally hard. MCMC methods such as metropolis algorithms and simulated annealing have been developed to be of use in precisely such situations. The output of single or multiple MCMC runs, moreover, can be put to much greater use by finding a set of optimal solutions (good set) for the auctioneers who have multiple objectives in mind...

3) Fuzzy DEA for Efficient Restructuring, Hong Choi, Yonsei University, Dept. of CS & ISE, Shinchondong 134, Seoul, Korea, sasman@yonsei.ac.kr, **So Young Sohn**

DEA has been effectively applied to various areas which need the evaluation of relative efficiency. We develop a DEA model based on fuzzy LP in order to consider uncertain synergy effects due to M&A of existing organizations. We apply the suggested approach to forecast the efficiency of merged academic departments in a university in Korea...

4) The Covariance of the Number of Renewals in a Fixed Time & the Ensuing Excess Life, Gregory K. Miller, Stephen F. Austin State University, 1936 North St., Box 13040, SFA Station, Nacogdoches, TX 75961, miller@math.sfasu.edu, http://math12.sfasu.edu/Faculty_Pages/miller

The title covariance is derived using matrix-geometric methods for the stationary PH-renewal process. Results for the Erlang and hyperexponential processes illustrate the ease of computation. Properties concerning sign and limiting behavior are provided. Estimation for renewal processes which cannot be fully observed is our motivation.

5) Asymptotic Dependence of Stationary Symmetric Stable Processes, Joshua Levy, University of Central Oklahoma, Dept. of Math. & Stats., 100 North University Dr., Edmond, OK 73034, jlevy@aix1.ucok.edu

Recent results are presented about the asymptotic dependence of certain stationary symmetric non-Gaussian stable processes. The codifference and covariation are useful to measure dependence in this case, since the covariance does not exist. We study their rates of decay applied to the long-term increments of a particular renewal-reward process and other processes.

WB10 Production & Scheduling IV

Contributed Session

Chair: Qiang Song, MAPICS, Inc., 11795 Ashwick Pl., Alpharetta, GA 30005, qiang.song@mapics.com

1) Cyclic Lotsizing & Scheduling in Job Shops: Investigating the Assignment Subproblem, Jamal Ouenniche, Eindhoven University of Technology, PO Box 513, Paviljoen H12, Eindhoven, 5600 MB, The Netherlands, j.ouenniche@tm.tue.nl, **J. Will M. Bertrand**

To solve the economic lotsizing problem through cyclic scheduling, we decompose the problem into 4 subproblems: choice of the vector of multipliers, the assignment of products to the basic periods of the global cycle, sequencing and lotsizing and scheduling subproblems. We investigate the assignment subproblem, propose several heuristics and assess their performance with respect to an optimal approach.

2) The Capacitated Lot-Sizing Problem with Setup Time & Setup Carryover, Yubo Gao, Hebei Institute of Technology, Dept. of Economic Mgmt., Tangshan, Hebei, 063009, PR China, gaoyubo@263.net, **Charles R. Sox**

The CLSP determines the production quantity and timing for several items on a single facility over limited periods. Production changeovers between different products incur setup time and cost. Setup carryover means the continuation of a production run from 1 period to the next without an additional setup.

3) Assignment of Liquid Chemicals to Ship Compartments, A. A. Eliman, University of California, Anderson Grad. Sch. of Mgmt., Riverside, CA 92521-0203, eliman@ucr.ac1.ucr.edu, **Mohsen El Hafsi, Bajis M. Dodin**

Corporations use oceangoing vessels to ship bulk chemicals among different ports. Products vary in physical characteristics, storage requirements and compatibility with other products. Ship compartments have different locations, sizes and wall material. We present MIP models to maximize the amount shipped while ensuring a well-balanced ship. Computational experience is also provided.

4) Solving Pull/Push Scheduling Problems with Linear Programming Models in Multi-Site Advanced Planning & Scheduling Systems, Qiang Song, MAPICS, Inc., 11795 Ashwick Pl., Alpharetta, GA 30005, qiang.song@mapics.com

As an extension of APS, multi-site APSs consider scheduling a customer order among different sites. There are 2 modes of scheduling: pull and push. Pull scheduling tries to schedule an order by the due date while push scheduling tries to finish the order at the earliest possible date. LP models are developed to solve these 2 scheduling problems. Numeric results are presented.

WB11 Statistics & Quality Control II

Contributed Session

Chair: M. Jeya Chandra, Pennsylvania State University, 310 Leonhard Bldg., University Park, PA 16802, mjc3@psu.edu

1) Utilization of Statistics to Understand Causality, Kemal Gursoy, Long Is University, 1 University Plaza, H-700, Brooklyn, NY 11201, kemal.gursoy@liu.edu, <http://www.phoenix.liu.edu/~kgursoy>

We tend to associate chain structures to unfolding events and relate a cause with the effect using this structure. Uncertainties are identified as stochastic events where we think that causality is embedded in them. Statistics are analyzed as instruments to understand causality.

2) A Statistical Method to Predict Insulation Strength from Experimental Data for at Least 2 Dielectrics in Series used on Distribution Line, Mohammad A. Quasem, Howard University, School of Bus., Dept. of IS&A, 2600 Sixth St., Washington, DC 20059, mquasem@howard.edu

We will examine the insulation strength for various items of apparatus on a system so that they are related to one another. Statistical methods will be developed toward the study of critical flashover voltage (CFO) data of a multiple series dielectrics for predicting CFO strength for different dielectric combinations.

3) Pattern Recognition using Principles of Quality Engineering, Jugulum Rajesh, Wayne State University, Detroit, MI 48202, rj1@sss.eng.wayne.edu, **Genichi Taguchi**

Principles of quality engineering, or Taguchi methods, have been applied in many applications to improve the performance of products/processes. These methods are proven to be simple and cost effective. We will show how these principles with Mahalanobis distance can be used in pattern recognition applications. Mahalanobis distance is used to recognize the different patterns...

4) Optimal Process Control of Turning Applications: A Bayesian Approach, M. Jeya Chandra, Pennsylvania State University, 310 Leonhard Bldg., University Park, PA 16802, mjc3@psu.edu, **Ian Cohen**

We develop optimal process control procedures to determine the time and amount of adjustment in a turning operation. Modified Bayes theory is used to estimate the parameters. The performance measure includes the adjustment cost and the expected loss per unit.

WB12 Networks & Graphs

Contributed Session

Chair: Kent Webb, San Jose State University, 13315 Simon Lane, Los Altos, CA 94022-3229, webb_k@cob.sjsu.edu

1) withdrawn - author request of 3/30, Arash Behzad, Sharif University of Technology, Azadi Ave., Tehran, Iran, **Mohammad Modarres**

2) An Exact Formulation & Algorithm for Capacitated Two-Commodity Network Design, Trilochan Sastry, Indian Institute of Management, Vastrapur, Ahmedabad, Gujarat, 380015, India, sastry@iimahd.ernet.in

We describe a polynomial algorithm to solve the 2-commodity capacitated network design problem where capacity is added in batches of C on each arc at non-negative cost. We also provide an exact LP formulation that guarantees integer optimal solutions using a polynomial number of variables and constraints.

3) A New Dual Algorithm for Shortest Path Reoptimization, Stefano Pallottino, Università di Pisa, Dip. di Informatica, 40, Corso Italia, Pisa, 56125, Italy, pallo@di.unipi.it, **Sang Nguyen, Maria Grazia Scutella**

Mainly in transportation applications, a sequence of shortest path problems often needs to be solved, where the problems differ only for the origin node. In the literature, dual reoptimization algorithms have been proposed to solve these problems efficiently. We describe a new algorithm which could be promising in practice.

4) Theory Essentials of Interdisciplinary Technology Management Studies, Yen-Der Lee, National Taipei College of Business, 321 Chinan 1st Rd., Taipei, Taiwan, 10022, ROC, yender_lee@yahoo.com

Blind commitment to a theory is not an intellectual virtue but crime. This meta-research of core literature proposes a model to identify the "theory essentials" of interdisciplinary technology management studies. The resulting science-map is cost effective for an initial but comprehensive understanding of the field since it clearly points to theory paradigms.

5) Distance Routing Algorithms, Kent Webb, San Jose State University, 13315 Simon Ln, Los Altos, CA 94022-3229, webb_k@cob.sjsu.edu

Current methods of finding routes through computer networks are presented with a focus on dynamic distance vector algorithms of the sort used for the ARPNET.

WB16 Analytical Dynamic Traffic Assignment

Sponsor: Transportation Science Section

Sponsored Session

Chair: Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu

1) Analytical Dynamic Traffic Assignment Models: Analysis & Algorithms, Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu, **Soulaymane Kachani**

We analyze a class of analytical models for the dynamic traffic assignment problem. Mathematical properties of these models are exploited in designing efficient algorithms. We show a variety of solution algorithms and computer implementations.

2) Efficient Algorithms for a Class of Analytical Dynamic Traffic Assignment Models, Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu, **Jennifer Farver**

We present continuous-time algorithms for a class of analytical DTA models in which origin-destination flow rates are stepwise time-dependent functions and link performance functions are affine. We show theoretical properties of this class of models and exploit them in designing solution algorithms that do not

discretize time. At the center of these developments are 2 efficient algorithms...

3) Applications of Analytical Dynamic Traffic Assignment Models, Ismail Chabini, MIT, Dept. of Civil & Environ. Eng., 77 Massachusetts Ave. Rm. 1263, Cambridge, MA 02139-4307, chabini@mit.edu, **Victor J. Blue**

We present results from applications of analytical DTA models to real-world traffic networks pertaining to the expressways and parkways network of Lower Westchester County and the Amsterdam beltway network.

WB17 Transportation II

Contributed Session

Chair: Maria Boile, Lafayette College, Dept. of Civil & Environ. Eng., Easton, PA 18042-1775, boilem@lafayette.edu

1) Near Real-Time Flow Estimation from a Sparse Set of Vehicle Detectors, Peter T. Martin, University of Utah, 160 South Central Campus Dr., Rm. 104, Salt Lake City, UT 84112-0561, martin@eng.utah.edu, civil.utah.edu/~martin, **Joseph Perrin**

Cities have many vehicle flow detectors embedded in the pavement. Some agencies can collect this flow information in real-time. We present a novel means of taking actual flow measurements and inferring unknown flows in near real-time. The concept takes a minimum cost flow optimization problem and inverts it into a flow estimation problem.

2) A System of Partial Differential Equations for Traffic Flow, Mostafa Ghandehari, University of Texas, Civil Eng. Dept., Box 19308, Arlington, TX 76019, gandeha@utarl.gu.ut.edu, **Siamak A. Ardekani**

A traffic flow model suggested by Lighthill, Whitham & Richards is discussed. A system of partial differential equations involving the density and velocity field for traffic flow is analyzed. Perturbation technique is used to linearize the system. A travelling wave solution of the corresponding linear system is given.

3) Intermodal Network Analysis, Maria Boile, Lafayette College, Dept. of Civil & Environ. Eng., Easton, PA 18042-1775, boilem@lafayette.edu, **Nancy Berrier, Steven Sivak**

We present a mathematical programming model which may be used to analyze intermodal transportation networks. The model has been used to evaluate congestion on various intermodal commuter corridors in New Jersey. Results of these analyses are presented.

WB20 Queuing & Inventory II

Contributed Session

Chair: Paul M. Thompson, US West Advanced Technologies, 4001 Discovery Dr., Boulder, CO 80303, pthomps@advtech.uswest.com

1) Effects of Finite Repair Capacity in Multi-Echelon, Multi-Indenture Service Part Supply Systems, Andrei Sleptchenko, University of Twente, PO Box 217, Enschede, 7500 AE, The Netherlands, a.sleptchenko@sms.utwente.nl

We examine the impact of finite repair capacity for a multi-echelon, multi-indenture supply system for repairable service parts. We show that the assumption of infinite capacity of repair may lead to a non-optimal solution and develop an algorithm where repair shops are modeled by multi-server queues.

2) Service Constraints in Serial Inventory Systems, Sven B. Axsater, Lund University, Dept. of IE, Box 118, Lund, S-221 00, Sweden, sven.axsater@ie.lth.se, <http://server1.ie.lth.se/IE/Sven/>

A continuous review serial inventory system with compound Poisson demands is considered. All deliveries must be multiples of given batch sizes. We consider the problem of minimizing the holding costs under a service constraint. Under reasonable assumptions, the optimal policy is a mixed echelon stock multi-stage (R,Q) policy.

3) A Periodic Tabular Policy for Scheduling of a Single Facility Multi-Item Production-Inventory System, K. Ravikumar, Indian Institute of Technology, IBM India Research Lab., New Delhi, 110 016, India, rkaruman@in.ibm.com, **Achal Bassamboo, Jain Sachin, Anshul Sood**

We discuss scheduling problems under base stock policies in a multi-item production-inventory system in the presence of random setup and production times. Demand streams are Poisson and any demand which cannot be filled from on-hand inventory is backlogged. Based on the residual service analysis for vacation queue models, we provide an approximation to variance of short-fall distribution...

4) Multi-Echelon Inventory Systems: Simulation Optimization,

Milind E. Bauskar, Capital One, 11011 West Broad St., Glan Allen, VA 23060, milind.bauskar@capitalone.com, **Charles P. Schmidt**

Simulation modeling offers systematic approach for learning the dynamics of inventory deployment strategies. Effective use of this tool empowers the management to formulate tactical and strategic options in the vibrant marketplace to best serve customers or cut costs. The simulation optimization illustrated here uses a kind of neighborhood search technique.

5) Sensitivity of Service Levels to Capital Expenditure for Reorder-Point Inventory Systems, **Paul M. Thompson**, US West Advanced Technologies, 4001 Discovery Dr., Boulder, CO 80303, pthomps@advtech.uswest.com

We develop a mathematical model of the relation between service levels and safety stock costs for reorder-point inventory systems. We consider 3 service measures: annual backorders, the expected lifetime of a backorder and the expected number of backorders extant at a point in time.

WB33 Developments in Priority Queues

Cluster: Queues

Invited Session

Chair: David A. Stanford, University of Western Ontario, Dept. Stats. & Actuarial Sci., Western Science Ctr., London, Ontario, N6A 5B7, Canada, stanford@stats.uwo.ca

1) A Preemptive Resume Queue with an Expiry Time for Retained Service, **Steve Drekić**, University of Waterloo, Dept. Stats. & Actuarial Sci., Waterloo, Ontario, N2L 3G1, Canada, sdrekić@math.uwaterloo.ca

The classic model of the preemptive resume priority queue assumes that when the server is again able to serve a preempted customer, the previously rendered service is saved and service simply resumes from the point of interruption. We introduce a new variant of the preemptive resume model in which the partially rendered service of an interrupted task is only retained...

2) A Matrix Geometric Model for a Priority Queue with Phase-Type Service, **Kandyan P. Sapna**, University of Western Ontario, Dept. Stats & Actuarial Sci., London, Ontario, N2L 3G1, Canada, sapna@stats.uwo.ca, **David A. Stanford**

We extend Miller's model for a 2-priority queue to an N-priority queue with class-dependent phase-type service. In a departure from the usual matrix geometric models, no bound on either queue length is required. Numerical examples are presented and the role of symbolic computing is highlighted.

3) A Matrix Geometric Model for Tandem Priority Queues with Phase-Type Service, **Kandyan P. Sapna**, University of Western Ontario, Dept. Stats & Actuarial Sci., London, Ontario, N2L 3G1, Canada, sapna@stats.uwo.ca, **David A. Stanford**, **Karuna Ramachandran**

We consider extensions of the previous model for a tandem arrangement of 2 2-priority queues with class-dependent phase-type service. We show how the state space can be exploited to ensure a layered structure of the R matrix in which each layer features upper or lower triangular (or Hessenberg) matrices. We hope to be able to present numerical examples.

- Abboud, Nadim TD20
 AbdelSalam, Hisham M. WA25
 Abid, Chafik TC30
 Aboolian, Robert MC28
 Abrams, Robert A. TA24, TE17
 Adelman, Irma MC24
 Adler, Jeffrey L. MB10
 Agnetis, Alessandro MC05
 Agnihotri, Sal R. MB06
 Agrawal, Mani TC10
 Agrawal, Naren MB09
 Agrawal, Vipul SD31
 Ahmadi, Reza MC09
 Ahmed, Shabbir MD14, SD13, TD14
 Ahn, Hyun-Soo WA33
 Ahuja, Ravindra K. MB26, TD12
 Aird, Tom MD26
 Ait-Kadi, Daoud TD20
 Akella, Ram MC08, SC31
 Akgun, Ibrahim MB04
 Albright, Chris MB29, SD34, TC35
 Alcaraz, Javier SC26
 Aldowaisan, Tariq TE05
 Alefeld, Goez E. TA15
 Alfa, Attahiru S. MD08
 Al-Hajri, Ibrahim Hindi TD21
 Al-Hajri, Khaled TD21
 Ali, Agha Iqbal MC32, SC24
 Alidaee, Bahram MC13
 Alizadeh, Farid SD15
 Al-Khabbaz, Nadia TD21
 Allahverdi, Ali TE05
 Allan, Rob MC25
 Allen, Theodore T. TA11, TC11, TD11
 Al-Otaibi, Musleh WA19
 Al-Sahhaf, Taher WA19
 Alsdorf, Charles MC29
 Al-Shammari, Jadaa MC19
 Al-Shihabi, Sameh WA33
 Alwan, Layth C. MC08
 Amini, Mohammad M. MC13
 Amouzegar, Mahyar WA03
 Anderson, Edward G. MB22, TA34, TC31
 Anderson, Edward J. TD13
 Anderson, Jason MD04
 Andersson, Kari TE16
 Andradottir, Sigrun WA33
 Andrews, John SC01
 Angelis, Diana I. WA27
 Anitescu, Mihai TA15
 Ankenman, Bruce A. TA11, TD11
 Apley, Daniel W. MC11, MD11
 Appleget, Jeff SD03
 Araman, Victor SC31
 Arcaro, Vinicius F. TD21
 Archer, Norman P. MD25
 Ardekani, Siamak A. WB17
 Ariyawansa, K. A. TA14
 Armacost, Andrew P. WA12
 Armacost, Robert L. WB05
 Armstrong, Deb TC22, TD22
 Armstrong, Nicholas MC04
 Arnold, Andrew MB04
 Arnold, Dieter MC17
 Arthaud, Greg J. MD19
 Arthur, Jeffrey L. MC20, TA19
 Asfour, Shihab SD07
 Askin, Ronald G. MC30
 Asmussen, Soren MD08
 Atkins, Derek SC31
 Au, Tom SD11
 Audet, Charles SD14
 Avi-Itzhak, Benjamin TC07
 Aviles, Ana I. TA11
 Aviv, Yossi SC10
 Axsater, Sven B. WB20
 Ayhan, Hayriye WA33
 Aykin, Turgut TA07
 Aytug, Haldun S. MC05
 Bacon, William R. TA21
 Badawy, Michael K. MB34
 Badinelli, Ralph D. SC10
 Bae, Jong Wook MD17
 Baeuerle, Nicole TC08
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 Zhu, Joe SC24, SD24
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 Ziliaskopoulos, Athanasios MC16, TD17, WA16
 Zimmers, Walt TD03
 Zipkin, Paul MD09
 Zobel, Christopher W. MD01

Sunday 13:00-14:30

- SC01 Decision Analysis Arcade: Innovations in Practice
 SC02 Monte Carlo Methods in Decision Analysis
 SC03 New Technologies & their Impact on Models & Simulation
 SC04 Military Analysis I
 SC05 Nicholson Student Paper Prize Competition I
 SC06 Panel: Designing Services for the 21st Century - Issues & Opportunities
 SC07 Manufacturing Improvement
 SC08 Probabilistic Models in Telecommunications
 SC09 Supply Chain Management
 SC10 Forecast-Adaptive Supply Chain Policies
 SC11 Panel: Challenges & Opportunities of QSR Methods - An Industrial Perspective
 SC12 Markov Decision Processes I
 SC13 Tutorial: Combinatorial Optimization: Current Successes & Directions for the Future
 SC14 Optimization in Support Vector Machines
 SC15 Convex Optimization & Complexity Issues
 SC16 Real-Time Transportation Systems I
 SC17 Recent Advances in Microscopic Traffic Simulation I
 SC18 In-Class Experiences with Cases from the Wiley/INFORMS Teaching Materials Initiative
 SC19 Telecommunications I
 SC20 Knowledge Management & Sharing
 SC21 Simulation I
 SC22 Organizational Management
 SC23 Sustainable Cities for the 21st Century: Rethinking the Problem
 SC24 Extensions of DEA
 SC25 Information Systems I
 SC26 Advanced Topics in Project Scheduling
 SC27 Pricing & Revenue Management I
 SC28 Location Models I
 SC29 Applications of Risk & Reliability
 SC30 New Advances in Production Planning & Scheduling
 SC31 Supply Chain Modeling
 SC32 Tutorial: Constraint Programming from an OR Perspective
 SC33 Preference Modeling
 SC34 Military Applications I
 SC35 Software Demonstration I

Sunday 15:00-16:30

- SD01 Strategy Implementation & Decision Analysis
 SD02 Decision Analysis
 SD03 New Developments in Military Simulation
 SD04 Military Applications II
 SD05 Nicholson Student Paper Prize Competition II
 SD06 Empirical Research in Service Design
 SD07 Manufacturing
 SD08 Reliability & Stochastic Orders
 SD09 Inventory Policies in Supply Chains
 SD10 Production Planning under Uncertainty
 SD11 Data Mining Applications
 SD12 Markov Decision Processes II
 SD13 Heuristic Search in Operations Planning & Scheduling
 SD14 Engineering Optimization
 SD15 SDP/SDLCP: Theory & Algorithms
 SD16 Real-Time Transportation Systems II
 SD17 Recent Advances in Microscopic Traffic Simulation II
 SD18 Tools for Undergraduate OR/MS Education
 SD19 Telecommunication Network Design
 SD20 Web Mining for Decision Support & Electronic Commerce
 SD21 Robust Selection Procedures for Computer Simulation
 SD22 Management & Technology
 SD23 Tournaments: Scheduling & Betting
 SD24 Applications of DEA

- SD25 Academic & Industry Collaboration on Supply Chain Management & E-Commerce
 SD26 Global Partnership, Quality, Information Systems
 SD27 Revenue Management & Booking Control I
 SD28 Location Models II
 SD29 Panel: The OR/MS Pipeline
 SD30 Distribution System Design
 SD31 Pricing & Contracts Design
 SD32 Constraint Programming
 SD33 Decision Making under Uncertainty
 SD34 Tutorial: Using VBA in a Management Science Course
 SD35 Software Demonstration II

Sunday 17:00-18:00

- SP36 Omega Rho Distinguished Lecture: Policy Modeling for Better Decisions - The Case of HIV Prevention

Monday 08:30-10:00

- MW36 Welcome & Awards Session

Monday 10:30-12:00

- MB01 Panel: Resolved - Decision Analysts should be Certified
 MB02 Decision Analysis & Risk
 MB03 Army Model & Simulation Standards
 MB04 Integer Programming Applications
 MB05 Scheduling I
 MB06 Service Encounter
 MB07 Operations Management I
 MB08 Applications of Markov Decision Processes & Applied Probability
 MB09 Retail Inventory Management
 MB10 Planning I
 MB11 Advanced SPC Methodologies & Implementations
 MB12 Applications of Markov Decision Processes
 MB13 Sequential & Cooperative Search in Combinatorial & Nonlinear Optimization
 MB14 Stochastic Programming: Models & Computation
 MB15 Extensions of Linear Optimization
 MB16 Dynamic Fleet Management
 MB17 Transportation Optimization
 MB18 The Use of (Reliance on) Spreadsheets to Management Science Concepts
 MB19 Telecommunications II
 MB20 Theory & Applications of Evolutionary Algorithms I
 MB21 Design of Simulation Studies
 MB22 Competencies that Promote Technology Leadership
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 MB25 Supply Chain Optimization
 MB26 Locomotive Planning Systems within Railroads
 MB27 Revenue Management & Booking Control II
 MB28 Location Models III/SOLA Dissertation Award Winners
 MB29 Teaching with Spreadsheets
 MB30 Production-Inventory Systems
 MB31 The Role of Commitment & Information in a Supply Chain
 MB32 Tutorial: Constraint-Based Scheduling
 MB33 Tutorial: The Spread & Nature of Automated Advisory Services on the Web - Perspectives from dot.com Launch
 MB34 Technology Management Education for the New Millennium: Challenges & Opportunities
 MB35 Software Demonstration III

Monday 13:00-14:00

- MP36 Plenary: On Doing Well by Doing Good

Monday 14:15-15:45

- MC01 Panel: The Future of Decision Analysis Software
 MC02 Decision Support Systems

- MC03 Verification, Validation & Accreditation of Models & Simulations
 MC04 Undergraduate OR/MS Project Showcase I
 MC05 Scheduling II
 MC06 Panel: Workforce Scheduling in Call-Centers - Bridging Theory & Practice
 MC07 Operations Management II
 MC08 Quality Regulation in Manufacturing & Service
 MC09 Logistics of Inventory for Effective Product Management
 MC10 FMS Scheduling
 MC11 Integration of SPC & APC
 MC12 Stochastic Decision Processes
 MC13 Heuristics for Large-Scale Combinatorial Problems I
 MC14 Tutorial: Stochastic Integer Programming
 MC15 Cone-Linear Optimization
 MC16 Goods Movement Modeling
 MC17 Transportation Routing
 MC18 INFORMS Case & Teaching Materials: Dialog with Instructors & Prospective Authors
 MC19 Environment & Natural Resources
 MC20 Theory & Applications of Evolutionary Algorithms II
 MC21 Simulation in Production
 MC22 Information Issues
 MC23 Global Efficiency & Benchmarking
 MC24 Economic Applications
 MC25 Supply Chain Management at IBM
 MC26 No Session Title Available
 MC27 Pricing & Revenue Management II
 MC28 Location Models IV
 MC29 Internet Applications
 MC30 Incorporating Human Issues into Manufacturing Planning
 MC31 Supply Chain Contracting & Coordination
 MC32 Tutorial: Integrating Multiple Mathematical Programming Models in Decision-Making Processes
 MC33 Advances in IBM's Optimization Solutions & Library I
 MC34 Technology Management: Emerging Issues
 MC35 Software Demonstration IV

Monday 16:00-17:30

- MD01 Decision Analysis & Information Systems
 MD02 Symposium: Studying the Ecological Rationality of Simple Heuristics
 MD03 Public Sector Enterprise Resource Planning
 MD04 Undergraduate OR/MS Project Showcase II
 MD05 Scheduling III
 MD06 Workforce Scheduling in Service Systems
 MD07 Material Management
 MD08 Stochastic Modeling & Computational Methods
 MD09 Supply Chain Models & Concepts
 MD10 Flexible Assembly
 MD11 Multivariate Statistical Quality Control: Methodology & Implementation
 MD12 Dynamic Programming & Transportation
 MD13 Heuristics for Large-Scale Combinatorial Problems II
 MD14 Non-Convex Stochastic Programming
 MD15 Robust Optimization
 MD16 Operations Research in Rail Operations
 MD17 Transportation Shipping
 MD18 Using Multimedia & the Web to Enhance Student Learning in the Management Sciences
 MD19 OR/MS in Forestry I
 MD20 Theory & Applications of Evolutionary Algorithms III
 MD21 Tutorial: Experimental Design for Simulation
 MD22 New Product & Technology Development
 MD23 Optimization in Electricity Generation
 MD24 Aspen Technology's e-Supply Chain Suite
 MD25 Information Systems II
 MD26 Data Access for Optimization
 MD27 Panel: Using Trading Rooms in Teaching & Research

- MD28 Facilities Planning & Design
 MD29 Simulation in Industry
 MD30 Models of Work Group Performance
 MD31 Managing Uncertainty in Operations
 MD32 Agent Technology I
 MD33 Advances in IBM's Optimization Solutions & Library II
 MD34 Panel: Publishing Technology Management Research in IEEE Transactions on Engineering Management
 MD35 Software Demonstration V

Tuesday 08:30-10:00

- TA01 Behavioral Decision Analysis
 TA02 Multicriteria Decision Making I
 TA03 Analysis Support in the Joint Staff & Combatant Commands
 TA04 Panel: The Future of Decision Analysis & Support
 TA05 Scheduling IV
 TA06 Service Design for Multiple Customer Segments/Groups
 TA07 Service Industry
 TA08 Applications of Applied Probability to Telecommunications
 TA09 Supply Chain Integration & Management
 TA10 Planning II
 TA11 Recent Work in Experimental Design I
 TA12 Scheduling, Delivery & Location
 TA13 Telecommunications & Heuristic Search
 TA14 Methods & Algorithms for Stochastic Programming
 TA15 Nonlinear Complementarity Problems
 TA16 Dynamic Routing & Scheduling
 TA17 Making Network Equilibrium Models More Realistic
 TA18 Student/Technology Issues in Web-Based Instruction
 TA19 OR/MS in Forestry II
 TA20 Performance Analysis of Queueing Models
 TA21 Simulation II
 TA22 Enterprise Information Technology Impact on Operational Performance
 TA23 Optimization within the Energy Sector
 TA24 IFORS Distinguished Lecture: or.edu & technology.com
 TA25 Business-to-Business E-Commerce: A Survey
 TA26 Reverse Logistics & Cash Flow
 TA27 Financial Engineering
 TA28 Topics in Computational Mixed Integer Programming
 TA29 Managing Product Variety I
 TA30 Technology Acquisition & Capacity Expansion
 TA31 Operations & Supply Chain Scheduling
 TA32 Agent Technology II
 TA34 Modeling Trade-Offs in Product Development Processes
 TA35 Software Demonstration VI

Tuesday 10:30-11:30

- TP36 Invited Plenary: Internet Technology at Western Governors University

Tuesday 13:00-14:30

- TC01 Group Decision Making
 TC02 Multicriteria Decision Making II
 TC03 Modeling Aggregated-Force Attrition
 TC05 Panel: Research Directions & Interesting Scheduling Problems
 TC06 Numerical Analysis in Service Design
 TC07 Research & Development
 TC08 Control of Queueing Networks & their Fluid Models
 TC09 Logistics I
 TC10 Supply Chain Management
 TC11 Recent Work in Experimental Design II
 TC12 Network Models for Logistics Management
 TC13 Diverse Applications of Metaheuristics
 TC14 Tutorial: Optimization in Medical Diagnosis & Treatment
 TC15 Optimization Techniques I

TC16 Routing & Scheduling of Vehicles & Crews
 TC17 Route Guidance
 TC18 Panel: Best Cases
 TC19 OR/MS in Forestry III
 TC20 Limit Behavior of Queues
 TC21 Industry Applications I
 TC22 Knowledge & Technology I
 TC23 Energy Issues
 TC24 Decision Models for Reuse
 TC25 Business-to-Business E-Commerce
 TC26 Tutorial: Realistically Modeling Transportation Costs
 TC27 Finance & Risk Management I
 TC28 Integer Programming Techniques to Real Applications
 TC29 Managing Product Variety II
 TC30 Operations Planning in Agile Assembly Centers
 TC31 Issues in Supply Chain Planning & Design
 TC32 Tutorial: Agents & Information Filtering
 TC33 Bounds & Approximations in Stochastic Programming
 TC34 Issues in Technology Management
 TC35 Software Demonstration VII

Tuesday 14:45-16:15

TD01 Naturalistic Decision Making: An Alternative to Traditional Decision Theory or a Prescription for Disaster?
 TD02 Multicriteria Decision Making III
 TD03 Current Topics in Defense Analysis
 TD04 MAS Session Honoring Dr. Seth Bonder
 TD05 Tutorial: Machine Scheduling with Availability Constraints
 TD06 New Paradigms in Designing Quality Systems
 TD07 Project Management
 TD08 Markov Decision Processes & Applications
 TD09 Logistics II
 TD10 Production & Scheduling I
 TD11 Recent Work in Experimental Design III
 TD12 Generalized Network Flow Problems
 TD13 Dynamic Programming
 TD14 Fractional Programming & Generalized Convexity
 TD15 Optimization Techniques II
 TD16 Airport Performance Predictors & Enhancements
 TD17 Optimization Problems in Stochastic & Dynamic Transportation Networks
 TD18 Some Mindles for Management Science
 TD19 OR/MS in Forestry IV
 TD20 Queuing Models of Spares Provisioning Systems
 TD21 Industrial Applications II
 TD22 Knowledge & Technology II
 TD23 Modeling Uncertainty in Electric Power Markets
 TD24 Supply Chain Issues for Reuse
 TD25 Mediating & Monitoring Business-to-Business E-Commerce
 TD26 Strategic Use of Logistics
 TD27 Finance & Risk Management II
 TD28 Applications of Integer Programming
 TD29 Managing Product Variety III
 TD30 Panel: Reengineering ERP
 TD31 Issues in Supply & Demand Management
 TD32 OR/AI Techniques in E-Commerce
 TD33 Queuing Modeling Subject to Power-Tail Distributions
 TD34 Simulation I
 TD35 Software Demonstration VIII

Tuesday 16:30-18:00

TE01 Generalizable Insights from Medical Decision Analysis
 TE03 Leveraging Information Technologies: Emerging Technical & Operational Opportunities & Challenges
 TE05 Scheduling I
 TE07 New Product Development

TE08 Multivariate Stochastic Orders & Dependence
 TE09 Logistics III
 TE10 Production & Scheduling II
 TE11 Statistical Methods for Reliability
 TE12 Network Design & Applications
 TE13 Forecasting
 TE14 Nonlinear Optimization in Marketing
 TE15 Transportation I
 TE16 Models for Efficient Use of Air Transportation Resources
 TE17 Characterizing Traffic Flow
 TE18 Education
 TE19 OR/MS in Forestry
 TE20 State Dependent Queues
 TE22 Panel: Research in Knowledge & Technology - The Accounting Information Systems Perspective
 TE23 Derivatives in Energy Pricing
 TE24 Environmental Decision Making
 TE25 E-Business & Business-to-Business E-Commerce
 TE26 System Design for Effective Logistics Management
 TE27 Finance & Risk Management III
 TE28 Difficult Combinatorial Problems
 TE30 Production Planning & Supply Chain Modeling in Remanufacturing & Demanufacturing
 TE32 Applications of OPL
 TE33 Queuing Potpourri
 TE34 Simulation II
 TE35 Software Demonstration IX

Wednesday 08:30-10:00

WA01 Generalizable Lessons from Government Decision Analysis
 WA03 Logistics & Military Simulation
 WA05 Scheduling II
 WA07 Marketing I
 WA08 Stochastic Models
 WA10 Production & Scheduling III
 WA11 Statistics & Quality Control I
 WA12 Network Models in Air Transportation
 WA16 Dynamic Traffic Assignment
 WA17 Airline Applications
 WA19 Resource Modeling
 WA20 Queuing & Inventory I
 WA25 Information Systems III
 WA27 Cost Performance Analysis
 WA28 Cutting Plane Approaches to Mixed Integer Programs
 WA32 Solving Large-Scale Spreadsheet Optimization Models in EXCEL with the MPL Modeling System
 WA33 Queuing Systems with Flexible Servers

Wednesday 10:15-11:45

WB01 DA 2000 & Beyond: How Industry is Learning & Applying Decision Analysis
 WB03 RAHMORS Contributed
 WB05 Scheduling 3
 WB07 Marketing II
 WB08 Stochastic Modeling
 WB10 Production & Scheduling IV
 WB11 Statistics & Quality Control II
 WB12 Networks & Graphs
 WB16 Analytical Dynamic Traffic Assignment
 WB17 Transportation II
 WB20 Queuing & Inventory II
 WB33 Developments in Priority Queues

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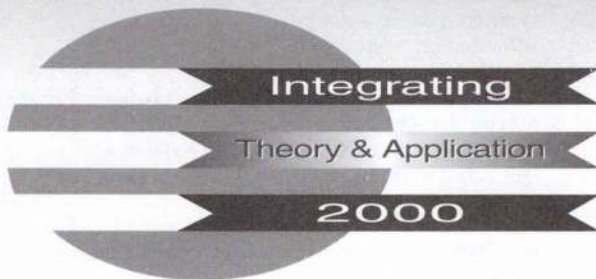


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Computational Mixed Integer Programming

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Green Manufacturing

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Integer Programming Applications

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Inventory Management

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Knowledge & Technology: Making the Connection

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Managing Product Variety

Mark Hillier, University of Washington, MS Dept., Sch. of Business Admin., Seattle, WA 98195; mhillier@u.washington.edu

Mathematical Modeling, Statistical Inference & Computational Methods in Queueing Systems

Sudha Jain, University of Toronto, Dept. of Statistics, 100 St. George St., Toronto, Ontario M5S 3G3 Canada; jainsu@utstat.utoronto.ca

Microscopic Traffic Simulation

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Non-Traditional OR

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Operations & Technology Strategy

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Pricing & Revenue Management

Georgia Perakis, MIT, E53-359, Sloan School, Cambridge, MA 02139; georgiap@mit.edu,

Production Planning & Control under Uncertainty

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Queues

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Queueing Potpourri

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Scheduling

Moshe Dror, University of Arizona, Dept. of MIS, Coll. of Bus. & Public Admin., Tucson, AZ 85721; mdror@mail.bpa.arizona.edu

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Simulation

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Supply Chain Management

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Teaching with Spreadsheets

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Telecommunications Network Design

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Undergraduate OR/MS Project Showcase

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Logistics

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Military Applications Society

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Manufacturing & Service Operations Management

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Optimization: Network Flows

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Optimization: Nonlinear Programming

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Optimization: Stochastic Programming

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(How to Get the Most Value) From an INFORMS Meeting

Welcome to the INFORMS Meeting. We describe how you can get the most value from an INFORMS meeting and from this program. It is designed for first-time attendees at an INFORMS meeting but others should also find it useful. INFORMS meetings and this program can be confusing and the INFORMS and local meetings committees want the meeting to be a rewarding experience for you.

Why People Attend

The primary activity at an INFORMS meeting is to present professional work. We offer suggestions on how to get the most value out of the sessions. There are other reasons to attend the meeting and we describe how to make the meeting as valuable as possible for these purposes, which may include:

- networking with colleagues;
- recruitment;
- meeting with colleagues in a specialty (subdivision);
- displaying or exploring exhibits;
- meeting with a small number of colleagues on a specific topic;
- learning from other types of sessions, i.e., tutorials and panels;
- other activities, i.e., plant tours.

Networking

• **Informal Discussions:** Networking is probably the major reason why many people attend an INFORMS meeting. The major means of networking are informal discussions in the common areas between sessions, during the lunch break and after

the daily set of sessions. There are usually one or two areas at the conference where attendees mingle, usually near the registration area or near the exhibits. Our members will often spend time in these areas for the simple purpose of finding colleagues. Other networking locations are around the coffee break locations.

- **General Reception:** Another major means to network is at the General Reception on Monday night, the major social meeting of conference. Generally, at least half of the attendees come to the general reception. Hors d'oeuvres are served buffet style and cash bars are set up with ample space to mingle and speak with friends and colleagues.
- **Business Meetings:** The business meetings are yet another means to network. These are the meetings of INFORMS subdivisions. Within these subdivisions, members develop strong professional relationships. The subdivision business meetings are held Sunday, Monday and Tuesday after the regular sessions and are a combination of business and socializing. The meetings provide an excellent way to meet colleagues with mutual interests and to join the "loop" of the subdivision. Many INFORMS members belong to more than one subdivision.

• **Exhibits**

The exhibit hall offers the chance to see recent publications and software. Vendors are eager to provide promotional copies and support to academics

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that may be thinking about using their materials in their courses.

Program

Of course, the most important part of an INFORMS meeting is the professional program, and it is important to understand how the sessions and program are put together. Most meetings have a professional theme that many of the sessions are aligned with. Building on this theme, the local committee puts together a professional program based on three primary types of sessions: invited sessions, sponsored sessions and contributed sessions. Invited sessions are planned by the local programming committee and can be geared towards the theme of the meeting. Sponsored sessions are organized by the subdivisions; these can also be considered invited in that a session chair appointed by the committee invites each speaker. Finally, contributed sessions consist of papers submitted by authors directly to the INFORMS office in response to the Call for Papers. All papers are accepted for these sessions.

Invited sessions are organized into groups of sessions known as clusters. The clusters are generally related topics and are the basis from which the meeting planners develop the professional program. These clusters are in turn related to the theme. The clusters are of interest to attendees as they define topic areas that they may be interested in. To facilitate planning, individual sessions from these clusters are scheduled in one or more tracks. A track is a collection of sessions that meet in the same room throughout the conference. To find out more about the availability of sessions in a cluster, refer to the Master Track Schedule to determine the days and times during which a cluster is scheduled and the number(s) of track(s) containing the cluster of interest.

While there are many sessions at the conference, popular sessions such as some tutorials may fill up quickly. It is best to arrive early. The technical sessions are also an excellent place to network, as there is time after each session to speak with presenters and request papers. It is a good idea to bring an ample supply of business cards with you.

Master Track Schedule (Matrix)

The Master Track Schedule is an overall view of the program. Tracks are listed in the left-hand column; regular session times are listed across the top. Each regular session lasts approximately 90 minutes. There is one track per room. There can be one or more cluster topic per track. One can see from the track schedule what tracks and their corresponding

topics might be of interest. While a track might consist of more than one topic and some related topics can appear in different tracks, the tracks are a useful way to navigate the program.

Special Sessions

The program includes a number of special sessions. A plenary presentation is given on a topic of broad interest to the membership and is the only presentation scheduled for a particular time period. Every meeting also has a number of tutorials, usually with a single speaker, devoted to a single topic. A tutorial gives an overview of the topic with a focus on the state-of-the-art knowledge or practice in the area. They are generally popular and well attended. A panel is developed to topics for discussion with several experts. They can involve any topic where the interaction will be useful to attendees.

Session Codes

The main body of the program lists the details of the tracks in chronological order. Each session is identified by a code to identify the day, session time and slot. A paper is referred to by this code and indicates the order it is to be presented in the session. For example, MA02.3 is the Monday session, time slot A, track 02 and the third presentation. This code appears directly before the paper title and is also used to identify presentations in the Participant Index at the back of the program.

In the body of the program, sessions are listed by day and time with the title of the session, the sponsor or cluster, the type of session and the room where the session is held. The session chair's name, affiliation, mailing address and email address are then indicated, followed by the title and authors of each presentation. The lead author's information will include affiliation, mailing address and email address and co-authors are listed by name only.

Front Material

Many of the special sessions, such as the tutorials and plenary or keynote presentations, are described in further detail in the front material pages. It is useful to review this material. The front material also contains subdivision meeting schedules, details about the host city and hotel and information on the social functions. A hotel floor plan is included in the final program; this is crucial in navigating your way through the meeting.

Indexes

The program includes a participant index listing the speakers alphabetically and giving the session codes for each of their presentations. There is also a

program index listing each session title for its particular session time.

Addendum

Be aware that there are a number of late changes to the program. The final program is sent to the printer several weeks before the meeting to allow time for printing and shipping to the meeting site. Additions, changes and withdrawals received after the final program is printed are listed in chronological order in the addendum that is distributed with registration materials.

INFORMS Online

The preliminary program is available online ONLY and is updated regularly until the meeting. This allows the

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flexibility of a longer time frame to accept papers and to continuously add to the program. The meetings programs are available on INFORMS Online (<http://www.informs.org>). You can identify specific sessions and print them out in an individual, customized program, search sessions using keywords and in general, map out your particular meeting plans at a more sophisticated level. It is important to try to plan as much as possible before you arrive at the meeting. Like many other endeavors, the value you get out of a meeting will depend on the effort you put into it. To this end, we recommend reviewing the program and technical sessions in advance. Navigating the meeting will then be an easy task.

Meeting Calendar

June 18 - 21, 2000

INFORMS-KORMS International Korea

General Co-Chairs:

Chaiho Kim

Santa Clara University

The Leavey School of Business

Santa Clara, CA 95053

408-554-6832

ckim@scu.edu

Dong-Wan Tcha

KAIST Graduate School of Management

207-43 Cheongryangri Dongdaemoon-Ku

Seoul 130-012 Korea

82 2 958 3377

tchadw@sorak.kaist.ac.kr

June 22 - 25, 2000

2000 Marketing Science Conference

UCLA, The Anderson School

General Co-Chairs:

Randy Bucklin & Donald Morrison

The Anderson School at UCLA

110 Westwood Plaza, B412

Los Angeles, CA 90095-1481

mktsci@anderson.ucla.edu

June 25 - 27, 2000

MSOM & Multi-Echelon Inventory Conference

University of Michigan

MSOM Co-Chairs:

Izak Duenyas

University of Michigan

Business School, 701 Tappan St.

Ann Arbor, MI 48109

duenyas@umich.edu

Rachel Zhang

University of Michigan, Dept. of IOE

Ann Arbor, MI 48109-2117

rzhang@engin.umich.edu

Multi-Echelon Inventory Chair

Tava Olson

University of Michigan, Dept. of IOE

Ann Arbor, MI 48109-2117

tlennon@engin.umich.edu

July 3 - 7, 2000

INFORMS Group Decision & Negotiation Section

University of Strathclyde

Glasgow, Scotland

General Chair: Melvin Shakun

New York University

44 West 4th St.

New York, NY 10012-1126

212-998-0479, fax 212-995-4003

mshakun@stern.nyu.edu

November 5 - 8, 2000

INFORMS San Antonio Fall 2000

San Antonio Marriott Rivercenter

General Chair: Way Kuo

Texas A&M University

College Station, TX 77843

409-845-5535

way@acs.tamu.edu

2001

May 20-22, 2001

INFORMS Conference on Practice

San Diego, CA

July 25 - 27, 2001

Applied Probability Society Conference

Co-sponsored by the Center for Applied

Probability at Columbia University

New York City

November 4 - 7, 2001

INFORMS Miami Beach Fall 2001

Fontainebleau Hilton

General Chair: Gary J. Koehler

University of Florida

Dept. of Decision & Info. Sciences

Warrington College of Business

PO Box 117169

Gainesville, FL 32611

352-846-2090, fax 352-392-5438

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Group Decision and Negotiation
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Information Systems
Location Analysis
Logistics
Management Control Systems
Management of Medical Technology
Management of Productivity
and Technology
Manufacturing and Service
Operations Management
Marketing
Optimization
Organization Science
Public Programs and Processes
Quality, Statistics & Reliability
Railroad Applications

Simulation
Social Science Applications
Technology Management
Telecommunications
Transportation Science

Societies:

Applied Probability Society
INFORMS Computing Society
Decision Analysis Society
Military Applications Society

Fora:

Association for Chairs of OR
Departments (ACORD)
Forum on Education
(INFORMED)
Women in OR/MS Forum

Chapters:

Atlanta
Boston
Chicago
Cincinnati/Dayton
Connecticut
Dallas/Fort Worth

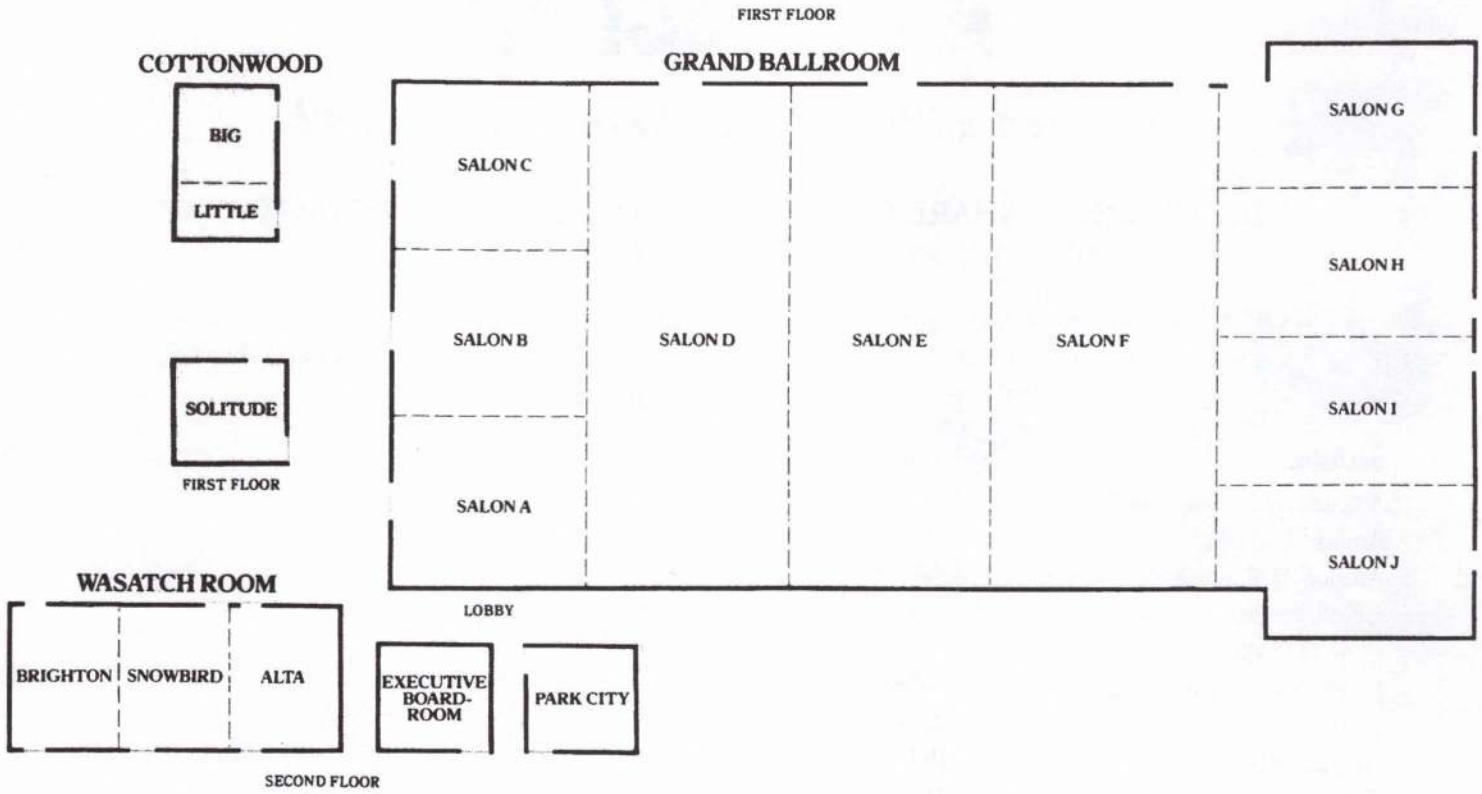
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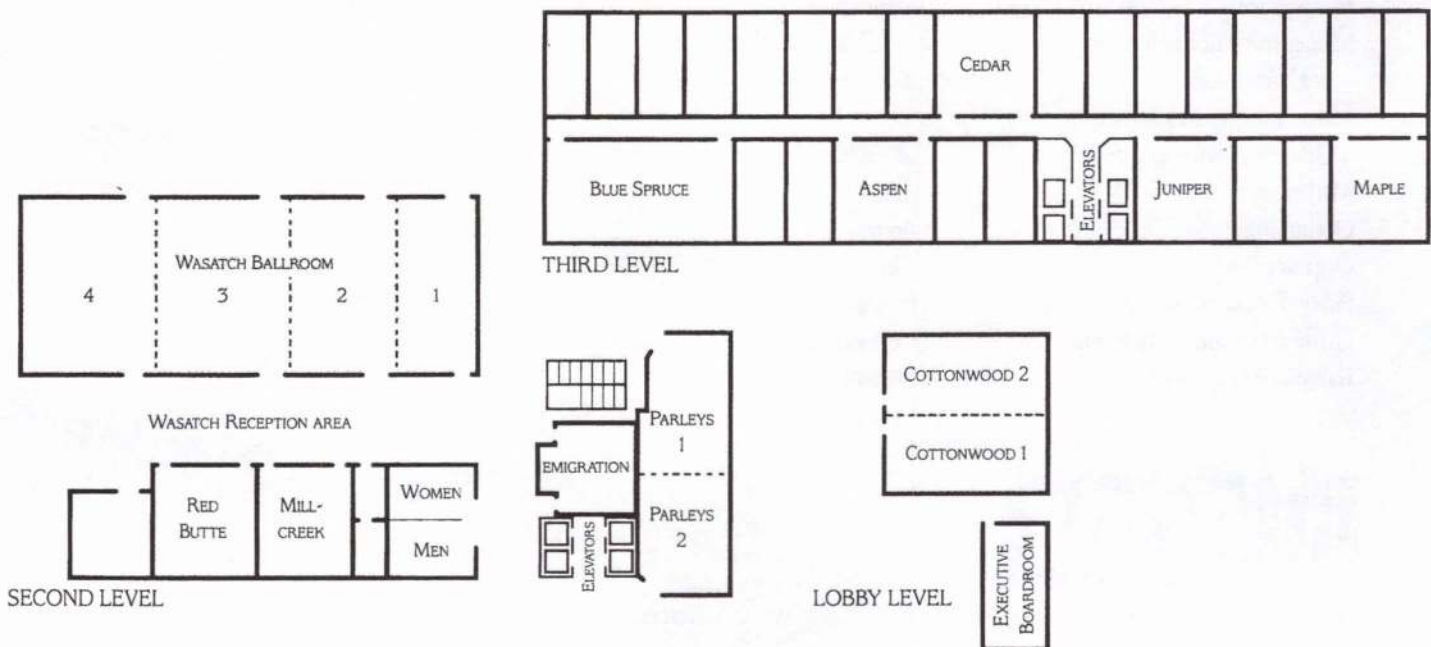
Institute for Operations Research and the Management Sciences

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Marriott Hotel

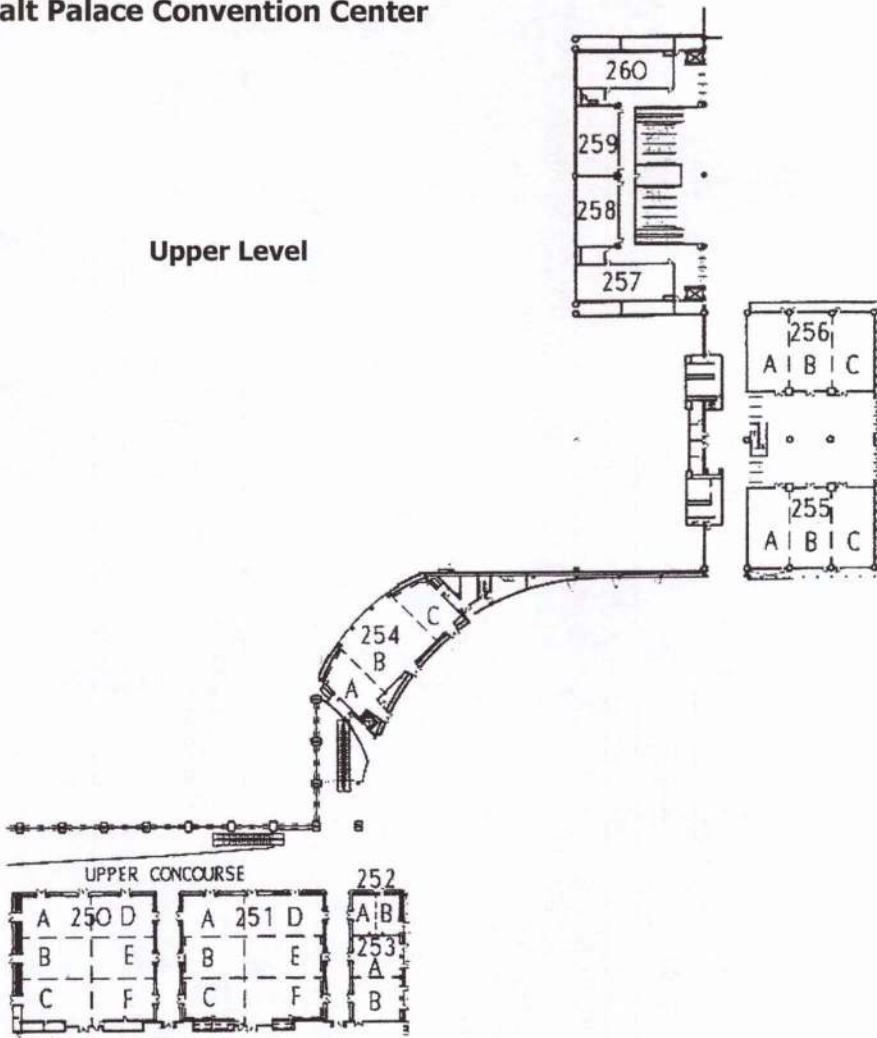


Wyndam Hotel

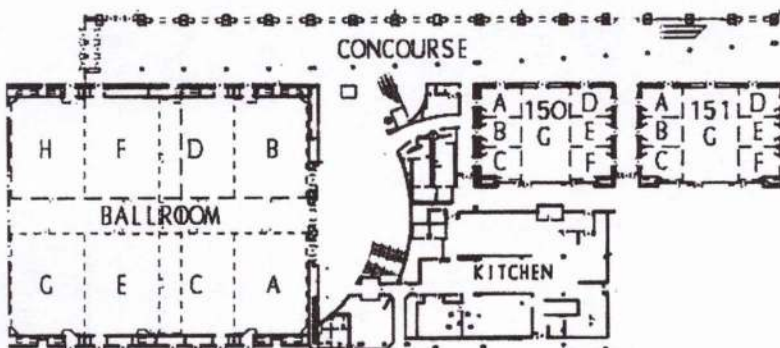


Salt Palace Convention Center

Upper Level



Lower Level



Room	Track
251D	1
251E	2
253A	3
253B	4
150D	5
150E	6
256C	7
254B	8
150F	9
151A	10
150G	11
151B	12
251A	13
255A	14
255B	15
256A	16
256B	17
254A	18
151C	19
151D	20
255C	21
151E	22
151F	23
151G	24
254C	25
257	26
252A	27
258	28
252B	29
251F	30
251C	31
251B	32
259	33
260	34
150C	35
250	36

INFORMS Salt Lake City Master Track Schedule

Room	Track	SC 1:00-2:30	SD 3:00-4:30	Plenary 5:00-6:00	Welcome 8:30-10:00	MB 10:30-12	Plenary 1:00-2:00	MC 2:15-3:45	MD 4:00-5:30	TA 8:30-10:00	Plenary 10:30-11:30	TC 1:00-2:30	TD 2:45-4:15	TE 4:30-6:00	WA 8:30-10:00	WB 10:15-11:45	
251D	1								Decision Analysis								
251E	2			Decision Analysis				DSS	DA		Multicriteria Decision Making						
253A	3								Military Applications								
253B	4					Military			DA & Support				Bonder				
150D	5	Nicholson Competition							Scheduling								
150E	6			Service Design													
256C	7	Manufacturing					Management			Serv. Ind.		R&D	Proj. Mgmt.	NPD	Marketing		
254B	8								Applied Probability							Stoch. Modeling	
150F	9			Inventory Management					Supply Chains				Logistics				
151A	10	Production Planning & Control under Uncertainty				Planning I		Flexible Mfg. Systems	Planning II			Supply Chains		Production & Scheduling			
150G	11							Quality, Statistics & Reliability							Statistics & Quality Control		
151B	12			Dynamic Programming									Network Flows			Networks & Graphs	
251A	13	Tutorial				Search in Combinatorial & Nonlinear Optimization						DP	Forecasting				
255A	14	Engineering Optimization						Stochastic Programming				Tutorial	Nonlinear Programming				
255B	15			Optimization: Linear Programming & Complementarity								Opt. Techniques	Transport.				
256A	16							Transportation									
256B	17	Traffic Simulation										Transportation					
254A	18							Education									
151C	19	Telecommunications							ENRE- Forestry					Res. Model.			
151D	20	Artificial Intelligence						Evolutionary Algorithms		Math. Modeling, Statistical Inference & Comp. Methods				Queueing & Inventory			
255C	21			Simulation				Tutorial	Simulation		Industrial Applications I & II						
151E	22	Management					Operations & Technology Strategy				Knowledge & Technology						
151F	23	Nontraditional Operations Research						Global Efficiency			ENRE - Energy						
151G	24		DEA					Econ. Apps.	Aspen Tech.	IFORS		Green Manufacturing					
254C	25	Info Syst. I				CPMS			Info Syst. II		Business to Business E-Commerce				Info. Syst. III		
257	26	Proj. Sched.	Global				RASIG		Computing		Logistics						
252A	27	Pricing & Revenue Management							Financial Services			Finance & Risk Management			Cost Perform.		
258	28			Location Analysis					Facilities		Computational Mixed Integer Programming						
252B	29	Apps. of R&R	Women OR/MS			Spreadsheets		Internet Apps	Simulation		Managing Product Variety						
251F	30							MSOM									
251C	31							MSOM									
251B	32							Computing Society									
259	33			Choice Engineering					OSL			Stoch. Program.			Queues		
260	34	Military Apps.	Tutorial					Technology Management					Simulation				
150C	35							Software Demonstrations									
250	36			Kaplan	Welcome		Woolsey				Mendenhall						

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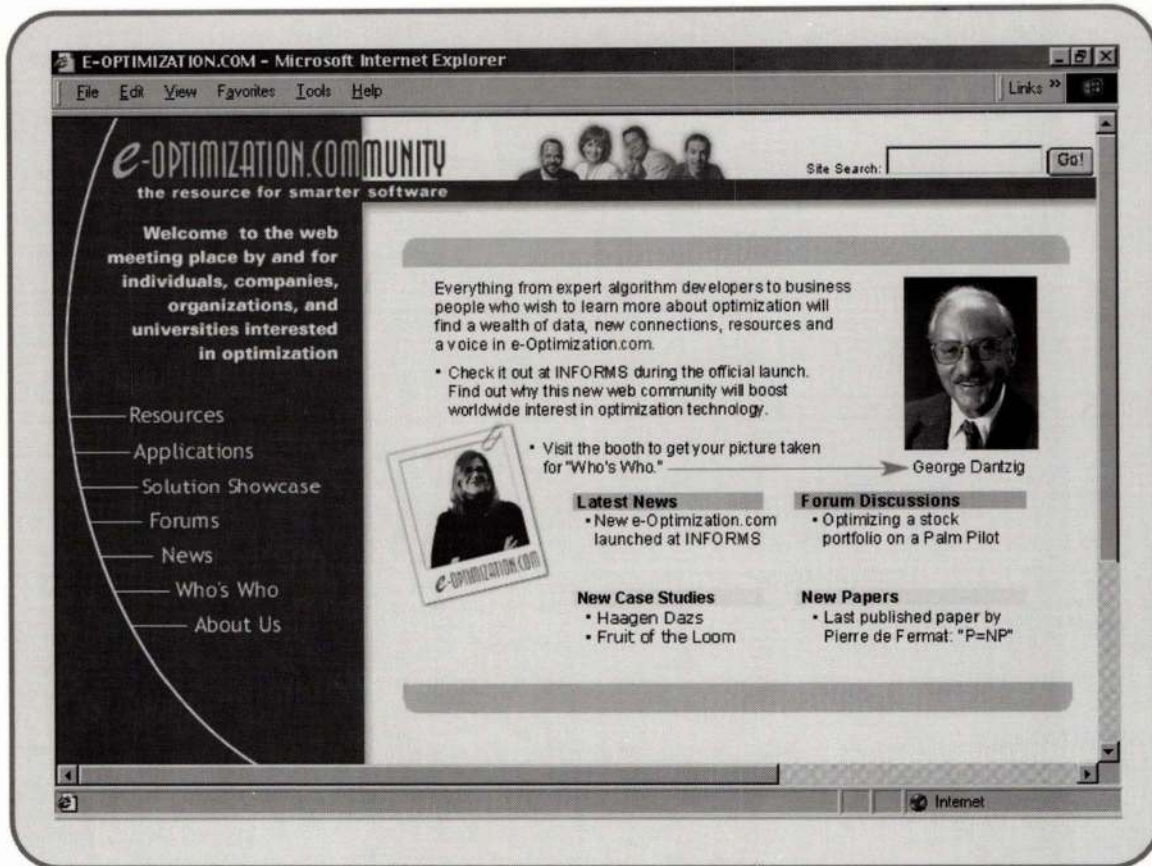
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