Tuesday, 8:00am - 9:30am

■ TA01

C-Room 21, Upper Level

Portfolio Decision Analysis I

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu

1 - Decision Analysis for Corporate Portfolio Strategy
Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

Portfolio applications come in many forms. In this session we will will examine the many dimensions of portfolio problems and then review a case study of a corporate business portfolio strategy. This portfolio strategy resulted in nearly doubling shareholder value and restructuring of the corporate enterprise.

2 - Challenges to Porfolio Decision Analysis in Organizations
David Matheson, SmartOrg, 855 Oak Grove Avenue, Suite 202, Menlo Park, CA 94025, United States of America dmatheson@smartorg.com, Jim Matheson

Portfolio management methodology far exceeds companies' ability to use it, and intervention-based consulting can limit lasting impact. The key is embedding good portfolio practices in the organization. Issues like raising the bar on critical thinking about economic issues, obtaining credible & comparable evaluations, tracking and learning are crucial. Dealing with the contradictions between good practices for project management and for portfolio management are especially challenging.

3 - ERA: A Framework and Interactive Scheme for Elicitation in Resource Allocation Decisions
Alec Morton, Lecturer in Operational Research, London School of Economics, Houghton St, London, WC2A2AE, United Kingdom, A.Morton@lse.ac.uk, Jose Figueira

We present a framework for thinking about Elicitation in Resource Allocation decisions, based on a constructive view of preference formation. We show how this framework can be the basis of a computationally practical interactive scheme and demonstrate this scheme with examples drawn from practice.

4 - Portfolio Decision Analysis of DOE's R&D on Energy Efficiency and Renewable Energy
Max Henrion, CEO, Lumina Decision Systems, Inc, 26010 Highland Way, Los Gatos, CA, 95033, United States of America, henrion@lumina.com, James Milford, Sam Baldwin, Walter Short, Surya Swamy

The US Department of Energy funds R&D in a wide range of energy efficiency and renewable energy technologies. The SEDS (Stochastic Energy Deployment System) model evaluates possible portfolios in terms of their effects on energy costs, GHG emissions, and oil imports. It is based on model of the entire US energy economy to 2050. It projects the market adoption of each technology based on expert elicitations of its performance and costs based on R&D funding levels.

■ TA02

C-Room 22, Upper Level

Value of Information

Sponsor: Decision Analysis
Sponsored Session

Chair: J. Eric Bickel, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

1 - The Value of Perfect Information as a Risk Measure
Philippe Delquie, INSEAD, Boulevard de Constance, Fontainebleau, France, philippe.delquie@insead.edu

The Value of Information measures the value that can be gained from resolving the uncertainty, i.e., removing the risk, in a gamble. Flipping it around, it may provide a good Measure of Risk.

2 - Value of Information in the Stochastic 0-1 Knapsack Problem
Kun Zan, PhD Student, The University of Texas at Austin, OR/IE, 1 University Station Stop C2200, Austin, TX, 78712, United States of America, kzan@mail.utexas.edu, J. Eric Bickel

Value of information (VOI) is one of the most important and interesting applications of decision analysis. Yet, despite much research, few general properties of VOI have been proved. Intuitive properties such as the value of information increasing as uncertainty is increased have been shown not to hold in general. In this paper, we consider VOI within the context of the stochastic 0-1 knapsack problem. We show that within this setting, some interesting and sometimes intuitive properties do hold.

3 - Relative Value of Information
J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

We investigate the value of imperfect information relative to perfect information (RVOI). Within the context of a two-action decision problem with normal priors and exponential utility, we derive a closed-form solution for the RVOI. These results deepen our understanding of information value and enable practitioners to estimate the value of imperfect information in particular settings.

4 - Impact of Risk Aversion and Value of Information in Lotteries
Onur Bakir, Postdoctoral Research Associate, University of Southern California, 3710 McClintock Ave, RTH 322, Los Angeles, 90034, United States of America, nbakir@usc.edu, Georgia-Ann Klutke

This study analyzes the information acquisition problem in a lottery setting. Information is evaluated using the buying price approach. We investigate the role of the decision maker's risk tolerance in valuing information bundles. In particular, we derive conditions under which there exists a monotonic relationship between the decision maker's risk tolerance and the value of information for generic information bundles. We illustrate our results with examples as well.

■ TA03

C-Room 23A, Upper Level

Integrated Methodologies for MCDA

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Theodor Stewart, Emeritus Professor of Statistical Sciences, University of Cape Town, Building 28 (P D Hahn), Room 307, Rondebosch, 7701, South Africa, Theodor.Stewart@uct.ac.za

1 - New Developments of the PROMETHEE & GAIA MCDA Methods
Bertrand Mareschal, Professor, Université Libre de Bruxelles, Boulevard du Triomphe CP 210-01, Bruxelles, 1050, Belgium, bmaresc@ulb.ac.be, Yves De Smet

We introduce developments of the PROMETHEE & GAIA MCDA methods. PROMETHEE provides rankings of a set of alternatives according to several decision criteria. New visual representations of the rankings are proposed and the elicitation of preference parameters is also considered. GAIA is a descriptive complement to PROMETHEE. New variants are proposed to give a better vision of the decision problem, to improve the link with the PROMETHEE rankings and to enhance the quality of the decision process.

2 - The D-SIGHT Project: The Next Generation of Promethee-Gaia Software
Yves De Smet, Professor, Université Libre de Bruxelles, Boulevard du Triomphe CP 210-01, Bruxelles, 1050, Belgium, yves.de.smet@ulb.ac.be, Bertrand Mareschal, Quantin Hayez

PROMETHEE and GAIA belong to the family of outranking methods. They provide both prescriptive and descriptive tools for multicriteria decision aid problems. This talk is a short tutorial of the new software based on this methodology. Key features such as new visual representations and sensitivity analysis tools will be illustrated. Among them special attention will be paid to new Gaia developments, to the "decision maker brain" function and to partial ranking investigations.

3 - Integrating DEA and Goal Programming for Performance Benchmarking
Theodor Stewart, Emeritus Professor of Statistical Sciences, University of Cape Town, Building 28 (P D Hahn), Room 307, Rondebosch, 7701, South Africa, Theodor.Stewart@uct.ac.za

We extend standard data envelopment analysis (DEA) to include longer term top management goals. The new model uses a goal programming structure to find points on the efficient frontier which are realistically achievable by DMUs, but at the same time achieving a closer approach to the long term organizational goals. Constraints on the DMU may be adjusted by investment in extended inputs or new technologies, giving investment cost as an additional management objective.

■ TA04

C-Room 23B, Upper Level

Joint Session ICS/DM Optimization in Data Mining/Machine Learning

Sponsor: Computing Society & Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu

1 - Solving the Sparse PCA SDP Relaxation
David Phillips, Assistant Professor, College of William & Mary, Math Department, Williamsburg, VA, 23185, United States of America, djphil@wm.edu, Garud Iyengar, Cliff Stein

In this presentation, we present an algorithm to solve the Sparse PCA SDP relaxation. Our solution algorithm solves a Lagrangian saddle point problem via a prox method of Nesterov's. Some key differences in our approach from previous algorithms is our use of a quadratic prox function and that we return feasible solutions to the SDP relaxation, where the former leads to a better run theoretical bound. Experimental results are presented.

2 - Relaxing Support Vectors with Linear and Quadratic Programming Models
Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, seref@vt.edu

In this talk, we introduce linear and quadratic programming models to relax vectors that are usually misclassified by maximal margin classifiers using a restricted amount of free (unpenalized) total slack. We introduce kernelized versions and emphasize important properties of these models. We also introduce a simple 2-phase method based on these models for multiple instance classification and present competitive computational results on public benchmark datasets and neurological data.

3 - From Pictures to 3D: A Global Optimization Approach
Manmohan Chandraker, University of California, San Diego, La Jolla, United States of America, mkchandraker@cs.ucsd.edu, David Kriegman, Sameer Agarwal, Serge Belongie

We present practical algorithms for achieving globally optimal solutions for 3D scene reconstruction from 2D images. We pose the non-convex problem as a fractional program and construct efficient convex envelopes to perform minimization in a branch and bound paradigm. A unified framework is developed for minimizing the standard L2-norm as well as the robust L1-norm. We demonstrate that exploiting domain knowledge can alleviate branch and bound's worst case exponential complexity in practice.

4 - Locally Linear Support Vector Machines
Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu, Vojislav Kecman

In this talk we present a new method for combining the k-nearest neighbors (KNN) and support vector machines (SVM) to produce a classifier that reflects local patterns in data. The Locally Linear SVM (LLSVM) is able to maximize margin and minimize error in the input feature space for points in the neighborhood of a query and derive globally complex separating surfaces. Theoretical evidence of the superior stability of LLSVM over global (traditional) SVM is given.

■ TA05

C-Room 23C, Upper Level

Operations and Management in Energy Industry I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Eunshin Byon, Texas A&M Universtiy, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@neo.tamu.edu

1 - Subproblem Approximation in Dantzig-Wolfe Decomposition of Energy Market Equilibrium Models
David Fuller, UWaterloo, 200 University Ave, Waterloo, Canada, dfuller@engmail.uwaterloo.ca, William Chung

The talk outlines the extension of Dantzig-Wolfe decomposition from pure optimization problems to variational inequality (VI) problems. Several ways to approximate the subproblem can produce better proposals, while retaining the theoretical convergence properties. Illustrations are given for a model of Canadian energy markets.

2 - Welfare and Incentive Effects of Energy Storage
Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

We examine the welfare effects of energy storage use and contrast the incentives of storage use amongst different agent types.

3 - Optimal Maintenance Strategies for Wind Turbine Systems Under Stochastic Weather Conditions
Eunshin Byon, PhD candidate, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@tamu.edu, Yu Ding, Lewis Ntaimo

We examine optimal repair strategies for wind turbines. Based on the information from sensors installed at turbines, our research objective is to derive an optimal maintenance policy that minimizes the expected average cost over an infinite horizon. We formulate the problem as a partially observed Markov decision process. Several critical factors, unique to wind farm operations, are considered. We derive a set of closed-form expressions for the optimal policy.

■ TA06

C-Room 24A, Upper Level

IEEE Transactions on Automation Science & Engineering Sponsored Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: N. Viswanadham, Assistant Professor, Clinical Professor, Indian School of Business, Hyderabad-500032, India, N_Viswanadham@isb.edu

Co-Chair: Yu Ding, Associate Professor, Texas A&M University, 3131 MS, College Station, TX, 77843, United States of America, yuding@iemail.tamu.edu

1 - Port-of-Entry Inspection: Sensor Deployment Policy Optimization
Elsayed Elsayed, Professor, Rutgers University, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu, Minge Xie, Yada Zhu, Hao Zhang, Christina Young

At the port-of-entry containers are inspected through a sequence of stations to detect illegal cargo. The inspection policy, which includes the sequence in which sensors are applied and the threshold levels used at the inspection stations, affects the probability of misclassifying a container as well as the cost and time spent in inspection. We will present our work in the optimization of such inspection systems, as well as recent investigation to reduce the effect of measurement error.

2 - Sensor Selection in Arbitrary Dimensions
Malik Magdon-Ismail, Associate Professor, Rensselaer Polytechnic Institute, magdon@cs.rpi.edu, Volkan Isler

We address the sensor selection problem which arises in tracking and localization applications. In sensor selection, the goal is to select a small number of sensors whose measurements provide a good estimate of a target's state. We focus on the bounded uncertainty sensing model where the target is a point in the d dimensional Euclidean space, and show that, on the plane, four sensors are sufficient to obtain an estimate whose area is at most twice the area of the best possible estimate.

3 - Identification of Influential Process Variables for Surface Quality Control in Hot Rolling
Shiyu Zhou, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706-1572, United States of America, szhou@engr.wisc.edu, Nong Jin, Tzyy-Shuh Chang, Howard Huang

Surface defects have been a long-term troubling issue in hot rolling processes. In this paper, functional data analysis and rigorous statistical testing are integrated to identify the process variables that significantly influence the surface quality of the finished products. The results can provide guidelines for root cause identification and surface quality improvement in hot rolling processes.

■ TA07

C-Room 24B, Upper Level

Quality Control for Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Tirthankar Dasgupta, Harvard University, Science Center, Dept of Statistics, 1, Oxford St, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu

1 - Statistical Models for Hot Electron Degradation in Nano-Scaled MOSFET Devices

Paul Kvam, Professor, Georgia Tech, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States of America, paul.kvam@isye.gatech.edu, Suk Joo Bae

In a MOS structure, the generation of hot carrier interface states is a critical feature of the device's reliability. On the nano-scale, there are problems with degradation in transconductance, shift in threshold voltage, and decrease in drain current capability. Quantum mechanics has been used to relate this decrease to degradation and device failure. We model the distribution of hot-electron activation energies, which exhibits two-point discrete mixture of logistic distributions.

2 - Profiling Nanoparticles

Chiwoo Park, Researcher, Texas A&M University, 241 Zachry Engineering Research Center, Texas A&M University, 3131 TAMU, College Station, TX, 77843-3131, United States of America, chiwoo.park@gmail.com, Yu Ding

Nanoparticles have many potential applications because of their unique and interesting properties shown in nanoscale. The properties are highly correlated with the size and the shape of nanoparticles, which is well known as "quantum confinement effect". For this reason, measuring and controlling the size and the shape is an important work in the development of new nanomaterials. Our research is on an autonomous procedure for measuring the size and the shape of nanoparticles processed.

3 - Weight Kinetics Modeling for Silica Nanowires Growth Catalysed by Pt Thin Film

Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu, Tirthankar Dasgupta, Yu An, Li Zhu

The nanostructure weight kinetics during growth is of interest. We first postulated the weight kinetics model based on an initial run of experiment and physical knowledge. A nonlinear piece-wise model was fitted with smooth transition between segments. Model comparison was conducted as well.

4 - A D-optimal Design for a Generalized Exponential Model Governing Growth of Nanowires

Tirthankar Dasgupta, Harvard University, Science Center, Dept of Statistics, 1, Oxford St, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu, Qiang Huang, Li Zhu

A locally D-optimal design for estimation of parameters of a complex curve characterizing nanowire growth that is partially exponential and partially linear is obtained using a geometric approach. A sequential algorithm is proposed for obtaining the D-optimal design. The convergence of the sequential algorithm to the D-optimal design is demonstrated using Monte-Carlo simulations.

5 - A Systematic Methodology for Robust Optimization of Nano-manufacturing Processes

Jye-Chyi Lu, Professor, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, 30332-0205, United States of America, jclu@isye.gatech.edu, Martha Grover, Justin Vastola

A Bayesian model for a batch nanoparticle synthesis process is upgraded to a stochastic-mechanistic simulation tool. Simulation data are used to build a statistical-mechanistic model of lower complexity. Physical data are then collected based on optimal experimental design plans to validate and improve the statistical-mechanistic model. Finally, the refined model is used for process optimization.

■ TA08

C-Room 24C, Upper Level

Pervasive Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Hui Xiong, Association Professor, Rutgers University, MSIS Department, 111 Washington Street, Newark, NJ, United States of America, hxiong@rutgers.edu

Co-Chair: Alexander Tuzhilin, New York University, atuzhili@stern.nyu.edu

1 - Collaborative Information Acquisition

Maytal Saar-Tsechansky, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, TX, 10012, United States of America, Maytal.Saar-Tsechansky@mccombs.utexas.edu

Prior work on information acquisition to improve predictive modeling focuses on learning a single model. However, given an acquisition budget, it is important to understand how we can enable predictive modeling techniques to collaboratively reason about information acquisitions so as to improve complex decisions. In this talk I will discuss this new problem, our approach to address it, and relevant applications.

2 - A Study of Quality and Accuracy Tradeoffs in Process Mining

Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, PA, 16802, United States of America, zanhuang@psu.edu, Akhil Kumar

In this talk we share our key insights from a study of mining process models from noisy real and synthetic logs. We propose self-loop and optional structures for the block-structured process model to deal with noisy log instances. By controlling the use of self-loop and optional structures around tasks and blocks of tasks we can balance the quality and accuracy tradeoff to derive high-quality process models that explains a given percentage of instances in the log.

3 - Optimization of Spatio-Temporal Clustering for Target Tracking From Multi-Sensor Data

Zhe Liang, Rutgers University, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu, W. Art Chaovalitwongse, Andrew Rodriguez

This study focuses on how to fuse both accurate and inaccurate information broadcasted from wide area search munitions (WASMs) and reconstruct the battle space for accurate target tracking. We propose a network model to represent all the feasible movement of the targets. An integer linear problem formulation is used to find the most probable target tracks. Our approach provided better results than the k-means clustering method for all the real world test cases.

4 - Direction Clustering for Characterizing Movement Patterns

Hui Xiong, Association Professor, Rutgers University, MSIS Department, 111 Washington Street, Newark, NJ, United States of America, hxiong@rutgers.edu, Wenjun Zhou, Yong Ge

In this talk, we introduce a direction-based clustering (DEN) method which aims to group trajectories with similar directions into the same clusters. Specifically, we partition the space into grids and introduce a probabilistic model to turn direction information in a grid into a vector with eight values to indicate the probabilities of moving towards eight directions within the grid. With this data transformation, we develop the DEN method and exploit it for understanding the user behaviors.

■ TA09

C-Room 25A, Upper Level

Applications of Queueing Theory

Sponsor: Applied Probability
Sponsored Session

Chair: Tolga Tezcan, Asst Prof, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, ttezcan@uiuc.edu

1 - Disitribution-Valued Heavy-Traffic Limits for the Processor Sharing Queue

Josh Reed, New York University, Stern Business School, 44 West Fourth Street, New York, NY, 10012, United States of America jreed@stern.nyu.edu

We study the GI/GI/1 processor sharing queue where the total capacity may vary depending upon the number of customers in the system. We first obtain a semi-martingale decomposition of the process keeping track of how much service each customer has received. Using this decomposition we then obtain fluid and diffusion limits. A criteria which depends on the capacity function is obtained for the diffusion limit to be stable. Steady-state distributions are also derived.

2 - Efficient Communication of Poisson Process with Applications in Flow Linking in Networks

Negar Kiyavash, Assistant Professor, University of Illinois at Urbana-Champaign, 128 CSL, 1308 W. Main, Urbana, IL, 61801, United States of America, kiyavash@illinois.edu

Linking network flows using flow timings is a crucial problem in intrusion detection and anonymity. This requires efficient communication of the timings to the decoder, classically done by first compressing and then transmitting the flow using a channel code. Due to delay and complexity requirements, it is desirable to bypass these steps. We drive sufficient conditions for optimal uncoded transmission of a Poisson flow with identity encoder and decoder mappings with zero-rate side information.

3 - Managing Service Systems with an Offline Waiting Option and Customer Abandonment

Vasiliki Kostami, University of Southern California, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, kostami@usc.edu, Amy Ward

We study a model that resembles the FASTPASS system in Disneyland, in which customers have the choice of waiting in a line or going offline; i.e., leaving and returning at a future time. We solve for the optimal capacity allocation, and estimate the in line and offline wait times. The estimation of offline wait times is complicated by the fact that some customers may not return for service.

4 - Robust Design of IVR Systems in Call Centers

Tolga Tezcan, Asst Prof, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, ttezcan@uiuc.edu, Banafsheh Behzad

We consider a call center system with a single customer class and a single server pool. Upon arrival, customers first use an interactive-voice-recognition (IVR) system before being transferred to an agent if necessary. We consider the design of the IVR system under demand rate uncertainty. Using fluid model approximations, we show how effective design of the IVR can improve service quality and decrease costs in a call center.

■ TA10

C-Room 25B, Upper Level

Joint Session APS/Inventory Management: Analysis of Stochastic Inventory System

Sponsor: Applied Probability & Inventory Management
Sponsored Session

Chair: Xiuli Chao, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, xchao@umich.edu

1 - Upgrading Policies During the Exploitation Phase for an Improved Component of a Capital Good

Kurtulus Baris Öner, PhD Student, Eindhoven University of Technology, Technische Universiteit Eindhoven, Postbus 513, Eindhoven, 5600 MB, Netherlands, K.B.Oner@tue.nl, Geert-Jan van Houtum, Gudrun Kiesmuller

We consider an OEM who is responsible for the availability of sold systems in the field. After the reliability improvement of one of the components of the system the OEM has to decide what policy to follow for upgrading the systems. We compare two basic policies: 1. Replace all components at once and 2. Replace a component when it fails. We determine the optimal costs for both policies and identify the situations where policy one is outperforming policy two.

2 - The Joint Pricing-procurement Control of a Make-to-Order Firm under Fluctuating Raw Material Prices

Yifeng Liu, New Jersey Institute of Technology, 323 Martin Luther King Jr Blvd, Newark, NJ, 07102, United States of America, yl222@njit.edu, Jian Yang

We consider a make-to-order firm that converts raw-material units into finished products. The raw material process is Markovian, while the order-arrival process is time-independent and yet elastic. We show the optimality of base-stock-list-price type of policies with the additional raw-price dependency. More importantly, we identify sufficient conditions on the raw-price process and the end-demand elasticity, under which policy parameters change in intuitive patterns when raw price changes.

3 - Integrated Planning of Spare Parts and Service Tools

Ingrid Vliegen, Technische Universiteit Eindhoven, Den Dolech 2, Paviljoen E15, Eindhoven, 5461BD, Netherlands I.M.H.Vliegen@tue.nl, Geert-Jan van Houtum

To perform a maintenance action, spare parts, service tools and service engineers need to be available. In this talk, we focus on the planning problem for a combination of tools and parts, based on an actual problem of an OEM in the semiconductor supplier industry. We consider a multi-location, multi-item inventory model, in which demands occur for sets of parts and tools. Our objective is to minimize the investment costs subject to meeting the service level agreed upon with customers.

■ TA11

C-Room 25C, Upper Level

Service Operations

Cluster: Queueing Models
Invited Session

Chair: Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu

1 - Irrationality in Queues

Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Achal Bassamboo, Tingliang Huang

In this talk, we consider a queuing system with a single server and homogeneous customer. Customer upon arrival observe the state of the system and make the decision whether to join the system or not. Based on Naor's model we know that if the customers are perfectly rational, then the social surplus is lower than the first best. We investigate how the system performance changes with customer's irrationality.

2 - Responding to Unexpected Overloads in Large-Scale Service Systems

Ohad Perry, Columbia University, New York, NY, United States of America, op2105@columbia.edu, Ward Whitt

We consider how two large-scale service systems that operate independently can help each other when one encounters an overload, involving a jump in the arrival rate. We propose a queue-ratio control, which activates sharing of customers by the service pools when a threshold is exceeded. This control requires no knowledge of the arrival rates. Our analysis is based on a fluid model, which includes a heavy-traffic averaging principle.

3 - Reserving Capacity for Urgent Patients in Primary Care

Sameer Hasija, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Sameer.Hasija@insead.edu, Gregory Dobson, Edieal Pinker

We examine the effect of reserving slots for urgent patients in a primary health care practice on two service quality measures: the average number of urgent patients that are not handled during normal hours and the average queue of routine patients. We present a stochastic "dam" model of appointment scheduling. We find that, for certain cases, performance may improve if no slots are reserved, i.e., patients are scheduled according to a rule similar to the Advanced-Access system.

4 - Appointment-driven Queueing Systems with Non-punctual Customers

Saif Benjaafar, Professor, University of Minnesota, Industrial and Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu, Oualid Jouini

Motivated by applications in healthcare, we study a queueing system where customer (patient) arrivals are driven by scheduled appointments. However, patients can be non-punctual and may arrive before or after their scheduled appointments or may even not show up. We allow for non-punctuality to be described by general distributions that may be patient-specific.

■ TA12

C-Room 26A, Upper Level

Computation Models of Air Transportation Management

Sponsor: Computing Society
Sponsored Session

Chair: Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, SEOR Dept, 4400 University Drive, Fairfax, VA, 22030, United States of America, khoffman@gmu.edu

1 - The Impact of Fuel Prices and Slot Controls on Airline Operations

John Ferguson, George Mason University, Mail Stop 4A6, Center for Air Transport, Fairfax, VA, 22030, United States of America, jfergus3@gmu.edu, Karla Hoffman, Lance Sherry, Abdul Qadar Kara

Airline behavior is driven by a combination of economic, network and political factors. Recent fluctuations in fuel prices and the addition of slot controls for Newark Liberty and New York John F. Kennedy airports provide a unique opportunity to examine these effects. This paper presents a model to examine airline behavior in the presence of slot controls and fuel price fluctuations and the impacts of these behaviors on the air transportation system.

2 - Gate-Waiting-Delay Causes and Mitigations at Major US Airports
Jianfeng Wang, George Mason University, 4450 Rivanna Ln # 3727, Fairfax, VA, 22030-4441, United States of America, jwang5@gmu.edu, John Shortle

Airport gates are one of the congestion points of the air transportation system. When an arriving flight lands on a runway, it is possible that it cannot pull into its gate due to gate unavailability. We define this phenomenon as gate-waiting delay. This paper investigates the functional origins of gate-waiting delays at several major US airports and discusses corresponding mitigation strategies.

3 - A Congestion Pricing Model to Handle "Day of Operations" - Airport Capacity Reductions
Abdul Qadar Kara, George Mason University, Mail Stop 4A6, Center for Air Transport, 4400 University Drive, Fairfax, VA, 22030, United States of America, akara@gmu.edu, Karla Hoffman, John Ferguson

We present congestion pricing models for use as a demand management tool for dealing with reductions in airport capacity due to inclement weather. These prices are based on both the congestion cost that flights impose on other flights needing the same resources and on the profitability of each flight. We present results for LaGuardia airport.

■ TA13

C-Room 26B, Upper Level

Optimization and Complex Stochastic Systems

Sponsor: Computing Society
Sponsored Session

Chair: Christine Shoemaker, Ripley Professor, Cornell University, 210 Hollister Hall, Ithaca, 14850, United States of America, cas12@cornell.edu

1 - Stochastic Control of Continuous-Time and Continuous-State Systems via Direct Comparison
Xiren Cao, Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, eecao@ust.edu.hk

The standard approach to stochastic control is dynamic programming. We introduce an alternative approach based on direct comparison of the performance of any two policies, by modeling the state process as a continuous-time and continuous state Markov process. The approach provides a unified framework for stochastic control and other optimization theory and methodologies. The new insights obtained may lead to new research topics.

2 - Knowledge Gradients With Monte Carlo Simulation In Online Learning Problems
Ilya Ryzhov, Princeton University, Princeton, NJ, 08540, United States of America, iryzhov@princeton.edu, Warren Powell

Suppose we have a set of alternatives whose true values are unknown, but can be estimated through expensive field tests. We allow correlations, so one test may provide information about multiple alternatives. If the number of alternatives is large, we propose a learning policy which uses Monte Carlo sampling to reduce the choice set to a small number of promising alternatives, and then applies a one-period look-ahead approach using knowledge gradients to choose among this reduced set.

3 - The Correlated Knowledge Gradient for Continuous Decision Variables
Warren Scott, Graduate Student, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, wscott@princeton.edu, Warren Powell, Peter Frazier

We extend the concept of the Correlated Knowledge-Gradient Policy for ranking and selection to the case of continuous decision variables. We propose an Approximate Knowledge Gradient, along with an algorithm to maximize it, which is applicable to a problem with a large set of feasible decisions. In the problem class considered, we use the Approximate Knowledge-Gradient to sequential choose where to sample an expensive noisy function in order to find the maximum quickly.

■ TA14

C-Room 27A, Upper Level

Optimization in Practice III - Logistics

Sponsor: Computing Society
Sponsored Session

Chair: Erica Klampfl, Ford Research & Advanced Eng., 2101 Village Rd., Dearborn, MI, 48124, United States of America, eklampfl@ford.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Multi-Depot, Multi-Destination, Mix-fleet School Bus Routing Problem
Sam Thangiah, Professor, Slippery Rock University, 250 ATS, Slippery Rock, PA, 16057, United States of America, sam.thangiah@sru.edu, Joseph Forsythe, Daniel Bly, Nethkelum Perera

We present a school bus routing system implemented to solve a real-life multi-depot, multi-destination, mix-fleet vehicle routing problem for a school district. The school district consisted of 1200 pickup points, 2000 students and 60 school buses. The precise distances between the pickup points were obtained using digitized road maps. The solutions obtained by the implemented system are compared with the routes in use by the school district.

2 - Depot-Level Capacity Model Requirements System (DLCMRS)
Donna Middleton, Operations Research Analyst, Northrop Grumman, 12900 Federal Systems Park Drive, FP1/3122P, Fairfax, VA, 22033, United States of America, Donna.Middleton@ngc.com, John Chalecky

Northrop Grumman has developed a linear programming model to assist the Marine Corps Logistics Command in calculating optimal depot-level maintenance capacity, and DoD 4151.18H factors. The model has the capability to provide a recommended configuration of the depot to optimally or near optimally achieve a given capacity, and to determine the impact of a specific change or set of changes on the current capacity.

3 - PuD Optimization in DHL International Americas
Felipe Villegas Moran, Head of Programms and Engineering, DHL Express IA, 110 N federal Hwy Appt 1103, Fort Lauderdale, United States of America, felipe.villegas@dhl.com

There is a substantial body of knowledge to apply when optimizing Pick Up and Delivery Operations. However in practice, companies are not always ready to profit from it. Often we find challenges in explaining solutions in business terms as well as limitations on systems, data, training and people. In this talk we discuss real world examples from an existent engineering that struggled to introduce OR into daily practice, translating complex models into simple tools.

4 - Intelligent Refueling Advisory System
Erica Klampfl, Ford Research & Advanced Eng., 2101 Village Rd., Dearborn, MI, 48124, United States of America, eklampfl@ford.com, Kacie Theisen, Oleg Gusikhin, Yimin Liu

With wild fluctuations in gas prices, services providing gasoline information are becoming increasingly popular. We present an advisory system that helps drivers minimize fuel costs through a mobile app/web interface: an underlying MIP uses vehicle information, gas prices, driver preferences, and a forecasting algorithm to provide future or missing gas prices.

■ TA15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - AnyLogic North America
Andrei Borschev, CEO and Managing Director, AnyLogic North America, 9 Ramsey Road, Lebanon, NJ, 08833, United States of America, andrei@xjtek.com

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

2 - Salford Systems - Introduction to Data Mining for Absolute Beginners

Mikhail Golovnya, Senior Scientist, Salford Systems, 4740 Murphy Canyon Road, #200, San Diego, CA, 92108, United States of America, golomi@salford-systems.com

This is a perfect place to start if you are new to data mining, even if you have little-to-no background in statistics. We will discuss: (1) data basics: data types, formats, and preparation steps; (2) what kinds of questions we can answer with data mining; (3) how data mining models work; (4) evaluation criteria—how models can be assessed and their value measured; and (5) specific background knowledge to prepare you to begin a data mining project.

■ TA16

C-Room 28A, Upper Level

Online Communities and Consumer Behavior in eCommerce Research

Sponsor: Information Systems
Sponsored Session

Chair: Jesse Bockstedt, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22201, United States of America, jesse.bockstedt@gmail.com

1 - Moderated Online Communities and User-Generated Content

Jianqing Chen, University of Calgary, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, jiachen@ucalgary.ca, Hong Xu, Andrew Whinston

To induce quality content for online communities, we introduce moderation into reputation systems. We show that under moderation commentators may display a pattern of reputation oscillation—-they generate useful content to build up high reputation and then exploit it. The expected performance from high reputations can thus be inferior to that from low reputations. We then discuss the optimal moderation resource allocation, and conclude that reputation oscillation may arise as an optimal result.

2 - Fall From Grace: Understanding Knowledge Retention in Online Collectives

Gerald Kane, Assistant Professor, Carroll School of Management, Boston College, 140 Commonwealth Ave, Chestnut Hill, MA, 02467, United States of America, gerald.kane@bc.edu, Sam Ransbotham

Little research has explored whether and how these collectives retain knowledge ñ a critical process in organizational knowledge management. Using the complete history data of 2065 Featured Articles on Wikipedia articles over a 7-year history, we analyze how collaborative processes help collectives retain knowledge and how processes associated with effective knowledge retention differ from those associated with knowledge creation.

3 - The Role of the Internet in Customized Products Supply Chains

Cheryl Druehl, Assistant Professor, George Mason University, School of Management, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu, Jesse Bockstedt

Over the past few decades, the mass customization movement has grown, pushed by steady advances in back-end strategies for producing custom products. However, true customization requires significant interaction with a consumer to capture specifications. The Internet provides the last technological link for developing an efficient customized products supply chain. We discuss strategies for customer-designed custom products, focusing on the additional costs/benefits for the customer and the firm.

■ TA17

C-Room 28B, Upper Level

Social Interactions in Business: Models and Processes

Sponsor: e-Business
Sponsored Session

Chair: Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

1 - Noncompetes and Brain Drains

Lee Fleming, Professor, Harvard Business School, United States of America, lfleming@hbs.edu, Matt Marx

We demonstrate that states that enforce noncompetes have lost inventors to states which do not. We provide historical data since 1975 and the results of a natural experiment from an inadvertent shift in noncompete enforcement in Michigan. We also demonstrate that it is inventors with the greatest human and social capital that are most likely to leave. Social capital is a stronger predictor, based on a measure of connectedness into the largest national component.

2 - Good, Bad, or Ugly? An Empirical Investigation of Feedback-Revoking Behavior on EBAY

Siva Viswanathan, Associate Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Shun Ye, Gordon Gao

This study investigates the selective revoking of negative feedback by sellers on eBay. Taking advantage of the recent changes in eBay's reputation system and the resulting strike, we find that sellers opportunistically revoke negative feedbacks under the old two-way system. However, denied the opportunity to retaliate against buyers under the new system, we find that these sellers improve the quality of their transactions and feedback scores.

3 - Impact of Recommender Systems on Volume and Diversity of Purchases

Kartik Hosanagar, Professor, The Wharton School, United States of America, kartikh@wharton.upenn.edu

We evaluate the impact of recommender systems on the volume and diversity of products consumers purchase online. A widely held view is that recommenders will fragment consumers, i.e. cause consumers to have less in common with one another. Our empirical study shows that users actually become more similar to one another in terms of their purchases. This similarity is because consumers change what they buy and also because they simply purchase more.

4 - Censoring, Interdependence and Scalability for Dyadic Social Media Data

Michael Braun, Assistant Professor of Management Science and Homer A. Burnell Career Development Professor, Massachusetts Institute of Technology, One Amherst St., E40-169, Cambridge, MA, 02139, United States of America, braunm@mit.edu, Andre Bonfrer

When analyzing social media data, we typically do not observe the full network, but without considering unobserved events, we get poor inferences and predictions. For a dataset of N individuals, there are N(N-1)/2 dyads to consider, so standard methods are generally intractable. Our nonparametric Bayesian method exploits the discreteness of the Dirichlet process to dramatically reduce the computational burden encountered when estimating models on networked data.

■ TA18

C-Room 28C, Upper Level

Network Design in Telecommunications

Sponsor: Telecommunications
Sponsored Session

Chair: Stefan Voss, Professor, University of Hamburg, IWI - Institute of Information Systems, Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@hamburg.de

1 - A Node Rooted Flow-based Model for the Local Access Network Expansion Problem

Luis Gouveia, Associate Professor of the Department of Statistics and Operations Research, Faculty of Sciences, at the University of Lisbon, Portugal, legouveia@fc.ul.pt, Margarida Goncalves

In the LANEP we need to expand a given tree network by increasing the capacity of the edges or by installing concentrating devices in some nodes of the network, in order to satisfy the increase in node demands. In this talk we present a new flow-based model that permits us to solve in an easier way, instances from the literature. We test and compare the new and old models for instances with 100, 200 and 500 nodes in order to show the advantages of the new proposed model.

2 - Lagrangian Approach for Bounded-Degree Spanning Tree Problem

Monica Gentili, Dr, University of Salerno, Via Ponte Don Melillo, Fisciano, SA, 84084, Italy, mgentili@unisa.it, Raffaele Cerulli, Francesco Carrabs, Manlio Gaudioso

We describe a variant of the spanning tree problem where we seek a spanning tree with the minimum number of branch vertices (that is vertices of the tree whose degree is greater than two). We study the Lagrangian relaxation of this problem and approach the solution of the Lagrangian dual by means of a finite ascent algorithm. We provide numerical results on some benchmark problems together with comparison with a standard subgradient procedure.

3 - Soliving the Minimum-cost Ring-cover Problem via Branch-and-Cut

Eli Olinick, Associate Professor, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, olinick@engr.smu.edu

The minimum-cost ring-cover problem is an important and difficult optimization problem arising in the design of reliable, high-speed telecommunications networks. We present an integer-programming formulation for this problem and an empirical analysis of a branch-and-price procedure for solving it.

4 - The Generalized Regenerator Location Problem
Si Chen, Assistant Professor, Murray State University, Murray, KY, 42071, United States of America, si.chen@murraystate.edu, Ivana Ljubic, S. Raghavan

In the generalized regenerator location problem (GRLP) we are given a set of candidate locations for regenerators (S), and a set of nodes that must communicate with each other (T). We wish to deploy as few regenerators as possible, while ensuring that all the nodes in T can communicate. We show that the GRLP is NP-Complete. We model the GRLP as a Steiner forest problem and provide computational results of two heuristics and the MIP formulation.

■ TA19

C-Room 28D, Upper Level

Routing Behavior and Traffic Assignment

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Laurie Garrow, Georgia Tech, 790 Atlantic Dr, Atlanta, 30332, United States of America, Laurie.Garrow@ce.gatech.edu

1 - Practical Implications of Finding Consistent Route Flows
David Boyce, Adjunct Professor, Northwestern University, 633 Clark Street, Evanston, IL, 60208, d-boyce@northwestern.edu, Hillel Bar-Gera, Marco Nie

Practical analyses of results from the static traffic assignment model are often based on route flows, even though route flows are not uniquely determined by the user equilibrium assumption. We compare route flow results aggregated to select link analysis from several solutions. An additional assumption of proportionality is suggested as a way to choose one route flow solution in a consistent and stable manner. We show the performance of different solutions in terms of proportionality.

2 - Stochastic Transportation Networks with Routing Inertia and Scenario Preference: Theoretical Basis and Modeling Method
Zugang Liu, Assistant Professor of Business Administration, Pennsylvania State University - Hazleton, 76 University Dr, Hazleton, PA, 18202, United States of America, zxl23@psu.edu, Chi Xie

Stochastic transportation networks with routing inertia and scenario preference: Theoretical basis and modeling method Abstract: A mixed-equilibrium traffic assignment problem for stochastic transportation networks with routing inertia and scenario preference is formulated, solved and numerically analyzed. The modeling method offers a new paradigm of describing day-to-day traffic dynamics due to network supply and demand variations and analyzing the network performance evolution from feeding traffic information to the driving population.

3 - How Far is Traffic From User Equilibrium? An Empirical Test of Wardrop's First Principle
Xiaozheng He, University of Minnesota, hexxx069@umn.edu, Shanjiang Zhu, Henry Liu, David Levinson

Wardrop's widely accepted first principle of User Equilibrium (UE) concept has not been validated with real data. This study tests the UE by using surveys and GPS data collected from Twin Cities Metropolitan area. Temporal and spatial measures are provided to capture the gap between the ideal UE condition and the observed conditions. The measures will further researchers and practitioners' understanding in developing and applying traffic assignment models based on UE.

4 - Non Monotonicity of Path Travel Time In Dynamic Traffic Assignment: Implications
H. Babai, Northwestern University, Evanston IL 60208, hamedalibabai2011@u.northwestern.edu, Hani Mahmassani

Existence of an interior equilibrium solution to dynamic assignment problems and convergence to such a solution has been predicated on the assumption of the monotonicity of the path travel time function. This paper shows that most realistic representations of traffic dynamics in a traffic assignment model are likely to result in violations of the monotonicity assumption.

■ TA20

C-Room 28E, Upper Level

Fleet Redistribution

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu

1 - Optimization in Operations of Alternative Fuel-Powered Fleets
Sevgi Erdogan, Research Assistant, University of Maryland, 1173 Glenn L.Martin Hall, Civil and Environmental Eng.Dept, College Park, MD, 20742, United States of America, serdogan@umd.edu, Elise Miller-Hooks

As businesses and agencies transition to fleets that rely on alternative fuels and vehicle technologies in an effort to reduce their contribution to global warming, numerous operational problems have arisen. In this presentation, one such problem, the alternative fuel-powered fleet operations problem, is formulated. Solution algorithms are proposed for its solution and results are evaluated on a test problem.

2 - Tractor Fleet Sizing and Repositioning Strategies
Jose Antonio Carbajal, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, acarbajal@gatech.edu, Alan Erera, Martin Savelsbergh

Trucking companies operating consolidation networks can attain cost savings by using tractor repositioning strategies. We investigate models to determine the value of executing repositioning moves (in addition to the ones required to balance resources throughout the network) as a means to reduce the system-wide costs associated with owning and operating a tractor fleet during a planning horizon. Several repositioning strategies are studied and computational results are shown for test instances.

3 - Fleet Redistribution for Vehicle Sharing Operations
Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu, Elise Miller-Hooks

A shared vehicle system involves a fleet of vehicles located across a network, from which users are free to checkout vehicles and return them to a station close to their destination. When demand is highly directional, fleet inventories at certain stations may be inadequate leading to rejected demand. A chance-constrained program is proposed that determines a least-cost redistribution plan such that most demand is satisfied.

■ TA21

C-Room 30B, Upper Level

Methods and Models for Road Pricing II

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Siriphong Lawphonganich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611-6595, United States of America, lawphong@ise.ufl.edu

Co-Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu

1 - Optimal Road Pricing In a Stochastic Dynamic Environment
Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Jing Dong

A Stochastic Dynamic Programming (SDP) technique is adopted to determine optimal road prices for real-time traffic management. The objective is to minimize the total travel time, while assuming each traveler chooses the least cost route. By incorporating field observations in the SDP, real-time road pricing schemes have the potential to account for nonrecurrent congestion, within-day dynamics, and instantaneous user response.

2 - A Computable Theory of Dynamic Congestion Pricing
Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, Dept of Industrial & Systems Engineering, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu, Terry Friesz, Taeil Kim, Tao Yao

We report on a theory of dynamic congestion pricing. The equilibrium design problem takes the form of an MPEC, which we call the Dynamic Optimal Toll Problem with Equilibrium Constraints, or DOTPEC. The DOPTEC maintains the usual design objective of minimizing the system travel cost by appropriate toll pricing. We describe how an infinite dimensional mathematical programming perspective may be employed to create an algorithm for the DOTPEC.

3 - On the Complexity of the Minimum Tollbooth Problem
Lihui Bai, Valparaiso University, 1909 Chapel Drive, Valparaiso, United States of America, Lihui.Bai@valpo.edu, Donald Hearn, Siriphong Lawphonganich

We study the complexity of a first best toll pricing problem that minimizes the number of toll booths (MINTB) required and simultaneously causes the tolled equilibrium to reproduce the system optimal flows. A reduction from the minimum cardinality multi-way cut problem shows that MINTB is NP-hard. Some variations of the NP-hardness results are also discussed.

4 - Properties and Design of Build-Operate-Transfer Scheme in General Networks
Di Wu, University of Florida, 518C Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, wudi@ufl.edu, Yafeng Yin, Siriphong Lawphonganich

This paper examines the properties of the equilibrium state in general networks with multiple private toll roads under a build-operate-transfer (BOT) scheme. Competing with others, private road operators decide capacities and tolls of the roads to maximize their own revenue. To ensure the public interest, a mathematical model is formulated for government agencies to select best BOT projects from a pool of candidates to maximize the social welfare.

■ TA22

C-Room 30C, Upper Level

Warehouse Operations I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - Analytical Models for Automated Storage and Retrieval Systems and Autonomous Vehicle Storage and Retrieval Systems
Sunderesh Heragu, University of Louisville, Department of Industrial Engineering, Louisville, KY, 40292, United States of America, s.heragu@louisville.edu, Cai Xiao, Ananth Krishnamurthy, Charles Malmborg

This paper presents semi-open queuing network based models for performance evaluation of Automated Storage and Retrieval Systems and Autonomous Vehicle Storage and Retrieval Systems. The models are validated against simulation and are used to provide design insights that could be used to determine the technology choice in different application scenarios.

2 - Does Class-Based Storage Really Reduce Travel Time?
Yugang Yu, Assistant Professor, Rotterdam School of Management, Erasmus University, T10-38,Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, yyugang@rsm.nl, Rene De Koster

Class-based storage is widely claimed to reduce travel time in a warehouse as compared to random storage. We study class-based storage allowing a storage space per product larger than its average inventory level. We develop a model and optimize the number and boundaries of classes to minimize the travel time to store or retrieve products. Examples show a larger number of classes may give a longer travel time.

3 - Stochastic Models of Warehousing using Systems
Manjunath Kamath, Professor, Oklahoma State University, School of Industrial Engr. & Mgmt., 322 Engineering North, Stillwater, OK, 74078, United States of America, mkamath@okstate.edu, Karthik Ayodhiramanujan

We develop analytical models for evaluating the performance of warehousing systems using a building block approach. We focus on two key building blocks, namely, a shared-server system, in which S/R servers store and retrieve items from a finite capacity rack and a queueing-inventory model that can handle changes in unit-load configurations (e.g., pallets and cases). We illustrate our modeling approach using an example warehouse system with forward and reserve storage areas.

4 - Integrated Analysis of Order Picking and Sorting Operations in a Rectangular Warehouse
Rakesh Nagi, Professor and Chair, University at Buffalo (SUNY), 438 Bell Hall, Buffalo, NY, 14260, United States of America, nagi@buffalo.edu, Melih Temel, Rajan Batta

We propose a new model that integrates order picking and sorting via an automated sorting system. We study different batching, zoning and sorting policies for the coordinated and efficient operations. We estimate the combined time spent on order picking and sorting for a batch of orders with greater accuracy and provide managerial insights on the above decision.

■ TA23

C-Room 30D, Upper Level

Defense Supply Chain Issues

Sponsor: Military Applications Society
Sponsored Session

Chair: Alan Johnson, Associate Professor, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, Wright-Patterson AFB, OH, 45433, United States of America, alan.johnson@afit.edu

1 - The Need for Accountability in the Military Information Supply Chain
Michael Grimaila, Air Force Institute of Technology, AFIT/ENV, Wright-Patterson AFB, OH, 45433-7765, United States of America, michael.grimaila@afit.edu, Evan Anderson, Joobin Choobineh, Robert Mills

Virtually all organizations embed information technologies into their core processes as a means to increase operational efficiency. Since the accuracy, conciseness, and timeliness of information can dramatically impact operations; the recognition and documentation of information dependencies is essential to gain a true appreciation of its operational risk. In this presentation, we discuss the need for accountability in the military information supply chain to assure the mission operations.

2 - Using Analysis to Support In-Theater Management of Contractor Logistics Support Contracts
Norman Reitter, Operations Research Director, Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15905, United States of America, reittern@ctc.com

Effective in-theater monitoring of logistics support contracts has been an issue in OIF and OEF for the past five years. This presentation will discuss how an integrated quality management approach supported by analysis is being used to manage logistics support contracts in a theater of operations to achieve improved efficiency and effectiveness while promoting partnering between stakeholders, the organization, and contractors.

3 - An Optimization of the Hub-and-spoke Distribution Network in United States European Command
Stephan Brady, Assistant Professor of Operations and Supply Chain Management, Penn State Harrisburg, E-355 Olmsted Building, 777 West Harrisburg Pike, Middletown, PA, 17057, United States of America, stephan.brady@psu.edu, Ben Skipper, William Cunningham

This research utilizes a Multiple Objective Linear Programming (MOLP) model to analyze hub locations in USEUCOM to determine the trade-offs between time and cost. The threat of multiple contingencies against unknown aggressors requires an efficient and effective network of locations for reception/forward movement of material. This network must be flexible enough to handle peacetime operations and to support unknown contingency, peacekeeping, or humanitarian efforts.

4 - Launch Vehicle Logistics Response Time Investigation
Alan Johnson, Associate Professor, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, Wright-Patterson AFB, OH, 45433, United States of America, alan.johnson@afit.edu, Carlos Molina, August Roesener

We investigate the effects and interactions of potential ground support and vehicle design factors for a proposed reusable military space launch vehicle, to identify a preferred design strategy that can minimize resource requirements necessary to achieve logistics response time goals. Our research uses an existing Arena discrete-event simulation in combination with JMP's Design of Experiment Enabler to screen approximately 50 candidate factors.

■ TA24

C-Room 30E, Upper Level

Newsvendor Economics

Cluster: Economic Models in Operations Management
Invited Session

Chair: Nicholas Petruzzi, University of Illinois, 350 Wohlers Hall, 1206 S. 6th St., Champaign, IL, 61820, United States of America, petruzzi@illinois.edu

1 - Newsvendors, Agents and Alignment
Anupam Agrawal, University of Illinois at Urbana-Champaign, Champaign, IL, 61820, anupam@illinois.edu, Nicholas Petruzzi

We have two objectives in this paper. First, we review the literature in the Principal-Agent theory from Economics, Finance and Operations to understand the current state-of-the-art, and the extant insights. Second, we analyze how uncertainty and risk affect contracting between principals, between agents, and between principals and agents. This is work in progress, and our main objective is to get feedback for further research.

2 - Public Policy Implications of the Newsvendor Model
Gal Raz, University of Virginia, Charlottesville, VA, 22903, razg@darden.virginia.edu, Yigal Gerchak

The supplying of a produced good is a game that includes three players, the firm supplying the good, the consumers that are buying it and the government that can intervene in the transaction by imposing rules and regulations. In this paper, we study a supply chain that sells a product to end consumers in a newsvendor setting, taking a social planner perspective and examining the possible government actions and their implications.

3 - Ordering, Pricing, and Leadtime Quotation under Demand and Leadtime Uncertainty
Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, bkazaz@syr.edu, Scott Webster, Zhengping Wu, Kum-Khiong Yang

We study the price-setting newsvendor problem in the presence of uncertain delivery lead-time. The demand for the product depends not only on the selling price, but also on the quoted lead-time. The firm has to carefully balance the holding cost and tardiness cost incurred from early and late completion of the product from the quoted lead-time. The paper determines the optimal selling price, quoted lead-time, and the inventory level simultaneously under demand and lead-time uncertainty.

■ TA25

C-Room 31A, Upper Level

Airport Operations II

Sponsor: Aviation Applications
Sponsored Session

Chair: Gautam Gupta, Associate Research Scientist, University Affliliated Research Center, Building 210, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States of America, gautam.gupta@nasa.gov

1 - Applying Regression and Queuing Model to Predict Taxi Times at Airports for Emission Reduction
Yu Zhang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, yuzhang@eng.usf.edu

How to reduce taxiing delay and consequent extra fuel burn and emissions has attracted enormous attentions from aviation community. This study propose a combination of regression and queuing models with an iterative algorithm to analyze the components of taxi times and predict taxi times. The performance of the model is validated through a comparison of its predictions with observed data at various airports.

2 - Integrated Taxiing and Take-Off Scheduling with Reordering at Runway Holding Points at Airport
Jacob Tsao, College of Engineering/San Jose State University, One Washington Sqaure, San Jose, CA, 95192-0085, United States of America, Jacob.Tsao@sjsu.edu, Wenbin Wei, Agus Pratama

We consider airports whose runway entrances are equipped with a holding point where any aircraft already having entered the holding point can take off ahead of any other aircraft still held at the holding point, and hence consider explicitly the feature of reordering aircraft at the entrance for more efficient take-off. We report integrated formulations as mixed-integer mathematical programming problems and our numerical experiences.

3 - A Review of Three Decades of Airport Runway Optimization
Mohammad Mesgarpour, PhD Student, University of Southampton, School of Mathematics, Highfield, Southampton, SO17 1BJ, United Kingdom, m.mesgarpour@soton.ac.uk, Julia A. Bennell, Chris N. Potts

The techniques and tools of Operational Research have been used to investigate, model, and optimize aircraft landing and takeoff as the principal bottlenecks of the air traffic control and airport system. The challenge lies in putting theory in practice which can simultaneously handle the safety, efficiency, robustness, competitiveness, and green environment. This paper addresses the airport runway optimization problem over the last three decades and also identifies the key future research.

4 - Value of Stochastic Runway Scheduling
Senay Solak, Assistant Professor, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@som.umass.edu, Ellis Johnson, Gustaf Solveling, John-Paul Clarke

Although runway operations contain significant uncertainty, stochastic scheduling models have not been considered for these problems. This is due to the assumption that the variances are low when decisions are made within short planning periods, and that such stochastic models are complex. We first present a novel, computationally efficient stochastic runway scheduling algorithm, and then discuss findings on the value of stochastic runway scheduling based on the two issues described above.

■ TA26

C-Room 31B, Upper Level

Edelman Finalists Reprise - II

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

1 - Norske Skog Improves Global Profitability Using OR
Kjetil Vatn, Norske Skog, Box 329, Lysaker, 1326, Norway, Kjetil.Vatn@norskeskog.com, Andy B. Philpott, Graeme Everett, Rune Gjessing

For paper maker Norske Skog uncertain demand and recession is a familiar situation, there has been a declining demand for years. Use of OR started in New Zealand as a regional supply chain model, later becoming a global model. In a recent case PIVOT was in downsizing the company. The MIP model was used to study a series of scenarios, giving confidence that the decision was optimal. Potential savings is about $120 million/year USD, equivalent to 3 % of annual turnover.

2 - Marriott International Increases Revenue by Implementing a Group Pricing Optimizer
Sharon Hormby, Senior Director, Marriott International, 10400 Fernwood Rd, Bethesda, MD, 20817, United States of America, Sharon.Hormby@marriott.com, Julia Morrison, Tim Tenca, Prashant Dave, Michele Meyers

Marriott International's Group Pricing Optimizer, a decision support system, provides guidance to hotel personnel in pricing hotel rooms for group customers. The system employs demand segmentation, price elasticity modeling and optimization techniques to recommend an optimal rate. In operation since late 2006, the system has improved profitability for hotels and enhanced the sales process for both sales managers and customers.

■ TA27

C-Room 31C, Upper Level

Simulation in Health Care II

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Rafael Diaz, Research Assistant Professor, Old Dominion University / VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, RDiaz@odu.edu

1 - A System Dynamic Approach to Modeling the Sensitivity of Inappropriate Emergency Department Utilization
Joshua Behr, Associate Research Scientist, Virginia Modeling, Analysis and Simulation Center, 1030 University Blvd., Suffolk, United States of America, jbehr@odu.edu

This research identifies the drivers manifest in the individual decision calculus to seek non-emergent services from the Emergency Department. We use System Dynamic (SD) M&S to measure the sensitivity of the two, often-competing, values of congestion and profitability and, thus, provide an additional layer of information designed to inform strategic decision making. We are able to identify the impact of alternate interventions among subpopulation vis-a-vis congestion and profitability.

2 - An Application of Simulation-based Optimization in ED's Resource Allocation

Rafael Diaz, Research Assistant Professor, Old Dominion University / VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, RDiaz@odu.edu, Peter Foytik

Successful efforts have been made in the development of simulations and optimizations that address health care management issues. Some authors have used simulation optimization to combine the virtues of both techniques, and thus, solve complex allocation problems. In our research, we investigate the effects of scheduling and illustrate the application of simulation-based optimization in an Emergency Department.

3 - Demand Forecasting for Real Options Valuation in Healthcare

Yun Shin Lee, PhD Candidate, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Stefan Scholtes

Real options in healthcare systems in rapidly changing demand circumstances are of value. We study simulation-based demand forecasting models for valuing such real options. Our first forecasting model is constructed from stochastic diffusion processes which are conventionally used in real options valuation. We propose an alternative demand forecasting model: adaptive trend fitting with stochastic forecast errors. We compare the two forecasting models using Monte Carlo Simulations.

4 - Effects of RFID Topology and Failure on Patient Flow and Health Care Quality

Mohammed Ferdjallah, Old Dominion University, United States of America, mferdjal@odu.edu, Joshua Behr

Advances in information processing and electronic medical recording have led to remarkable improvements in heath care management. Radio frequency identification devices (RFID) are currently used to enhance patient flow and resources management. As RFID technology becomes integrated in the management, the efficiency and failure would negatively impact the outcome of health care. We used a simulation model to investigate the effects of using RFID on patient flow in an emergency department.

■ TA28

H-Room 500, Fifth Floor

Cooperation and Competition in Networks

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Parijat Dube, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10598, United States of America, pdube@us.ibm.com

Co-Chair: Rahul JainAssistant Professor, University of Southern California, Department of Electrical Engg. - Systems, EEB 328, 3740 McClintock Avenue, Los Angeles, CA, 90089, United States of America, rahul.jain@usc.edu

1 - Real-time Wireless Spectrum Markets

Randall Berry, Associate Professor of EECs, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, rberry@eecs.northwestern.edu

There is an increasing awareness that current policies for allocating wireless spectrum are inefficient. One approach to remedying this is via "real-time" spectrum markets. A challenge in implementing such markets is accounting for the interference among different users of spectrum. We describe models for such a market which leverage different communication paradigms for managing interference and study the efficiency of the resulting market mechanisms.

2 - Architecting Efficient, Stable, and Fair Random Access Networks: A Conjectural Equilibrium Approach

Yi Su, University of California Los Angeles (UCLA), 54-147A Engineering IV Building, 420 Westwood Plaza, Los Angeles, CA, 90095, United States of America, yisu@ee.ucla.edu, Mihaela van der Schaar

For wireless LANs, such as IEEE 802.11 networks, the channel utilization efficiency, the system stability, and the fairness of bandwidth allocation are three important issues when designing their medium access control (MAC) protocols. This paper aims to design a simple access mechanism optimized for all the aforementioned issues from a game theoretic perspective using a conjectural equilibrium approach.

3 - Congestion Games and Their Application to Spectrum Sharing

Mingyan Liu, Associate Professor of EECS, University of Michigan, EECS Department, 1301 Beal Avenue, Ann Arbor, MI, 48109, United States of America, mingyan@eecs.umich.edu, Yunnan Wu, Sahand Ahmad

Recent advances in software defined radio give wireless devices the ability to dynamically access spectrum. This talk presents decentralized spectrum sharing mechanisms using a congestion game framework. While with some very appealing features, the standard congestion game does not capture pair-wise interference in wireless communication. We address this using two approaches, the first through a re-definition of resources and the second through an extension to the congestion game.

4 - Equilibrium and Efficiency in Multi-class Queueing Games

Rahul Jain, Assistant Professor, University of Southern California, Department of Electrical Engg. - Systems, EEB 328, 3740 McClintock Avenue, Los Angeles, CA, 90089, United States of America, rahul.jain@usc.edu, Parijat Dube

We develop a framework to study differentiated services when there are competing network providers. We model the relationship between capacity, QoS and prices offered by service providers in a competitive network services market. We establish sufficient conditions for existence of Nash equilibrium in the multi-class queueing game. We also explore characterization of inefficiency in the multi-class queueing game model.

■ TA29

H-Room 501, Fifth Floor

Simulation Models in Energy Markets

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

Chair: Augusto Micola, Assistant Professor, Universitat Pompeu Fabra, Ramon Triaas Fargas 25, Barcelona, Spain, augusto.ruperezmicola@gmail.com

1 - Simulating Wholesale Electricity Markets: The Devil is in the Details

Albert Banal-Estanol, Assistant Professor, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, Barcelona, 08005, Spain, A.Banal-Estanol@city.ac.uk, Augusto Micola

This paper uses an agent-based model of wholesale electricity markets to explore issues of model validity and consistency. We address the issues of software standardisation and theoretical validation. We study several supply and demand specifications and propose an algorithm based on the "experience weighted attraction modelwhich encompasses the existing behavioural algorithms of the literature.

2 - Agent-based Modeling of Supply Function Equilibria in Electricity

Steven Kimbrough, Professor, University of Pennsylvania, Wharton Business School, Philadelphia, PA, United States of America, kimbrough@wharton.upenn.edu, Fred Murphy

Supply function equilibrium models have few usable theoretical properties for understanding electricity markets. In this paper we add more realism to a supply-curve equilibrium model using an agent-based model. We examine two aspects that are missing, First, we look at the effect of fixed costs in bidding in the day-ahead market. Second, we introduce forward markets and examine what the agents do.

3 - Design and Implementation of a Multifunction, Multimarket Simulator

Gerald Sheblé, Professor, University of Porto/INESC, Rua Dr. Roberto Frias, 378, Campus da FEUP, Porto, 4200 - 465, Portugal, gsheble@inescporto.pt, Vladimiro Miranda

This paper presents a market simulator design that is flexible to support maintenance scheduling in a regulated environment and multi-market simulation in a competitive market. The first is a multiple market simulation of an ISO including Energy, Load Following, Frequency Following, and Reserve, as well as environmental (CO2) market. This is a competitive environment including renewable resources and electric vehicles. The algorithms and results implemented will be included.

4 - Learning and Cost Shocks Adaptation in Energy Markets

Stephane Tchung-Ming, Researcher, IFP, 258 avenue Napoleon Bonaparte, Rueil-Malmaison, 92852, France, Stephane.tchung-ming@ifp.fr, Olivier Massol

We use a learning algorithm to study how agents adapt to cost shocks. An application is proposed to analyse the indexation structure of natural gas contracts in a stylised baseload electricity market.

■ TA30

H-Room 502, Fifth Floor

Open Pit Mine Planning, I

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

Chair: Marcos Goycoolea, Universidad Adolfo Ibañez, Diagonal Las Torres 2640, Peñalolén, Santiago, Chile, mgoycool@gmail.com

1 - Strategic Mine Planning: A New Scalable Approach to Optimal Block Scheduling

Eduardo Moreno, Universidad Adolfo Ibañez, Avda. Diagonal Las Torres 2640, Santiago, Chile, eduardo.moreno@gmail.com, Daniel Espinoza, Marcos Goycoolea

A critical aspect of long-term open-pit mine planning consists in designing a block extraction schedule.This problem can be modeled with integer-programming, but the size of typical block models makes intractable to standard solvers. In this talk we present a scalable integer-programming based methodology for solving very large (millions of blocks) instances of this problem. Using these techniques we are able to obtain near-optimal solutions to large problems in a few hours.

2 - Open Pit Block Sequencing Using Valid Cuts and Lagrangian Relaxation

Brian Lambert, Colorado School of Mines, United States of America, wlambert@mines.edu, Alexandra Newman

An open pit mine optimizes profits by maximizing the net present value of the extracted orebody. An exact method to determine the block extraction sequence is formulating the problem as a mixed integer program with a time-indexed binary variable for each block representing if and when the block is extracted. We utilize valid cuts and Lagrangian relaxation to reduce solution times, providing numerical results obtained from data sets of tens of thousands of blocks and up to 15 time periods.

3 - Network Optimization and Open Pit Mining

Kadri Dagdelen, Professor, Colorado School of Mines, Mining Engineering Department, 1600 Illinois Street, Golden, CO, 80401, United States of America, kdagdele@mines.edu

Abstract not available at this time.

■ TA31

H-Room 503, Fifth Floor

Pricing and Revenue Management: Beyond Revenue

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Darius Walczak, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dwalczak@prospricing.com

1 - Salesforce Incentives in Revenue Management

Ayse Kocabiyikoglu, Bilkent University, Faculty of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr, Ioana Popescu

We investigate a revenue management setting where capacity allocation decisions are delegated to an agent, incentivized on salary plus commission. We compare the agent's allocation decision with the firm optimum, and suggest how the firm can design salesforce incentives to better match objectives. We study the effect of agent's preferences, contract parameters and market forces on the agent's decision.

2 - Dynamic Pricing with Two Revenue Streams

Michael Li, Nanyang Business School, Nanyang Technological University, Singapore, Singapore, ZFLI@ntu.edu.sg, Weifen Zhuang

This paper studies the dynamic pricing problem with inventory revenue and ancillary revenue. If the inventory revenue dominates, we show that integrating ancillary revenue into dynamic pricing will set a lower inventory price. If the ancillary revenue dominates, we extend dynamic pricing with homogeneous customers to incorporate multiple segments differentiated through ancillary revenues. Our findings should shed new light on customer valuation and profiling.

3 - Business Metrics and a Revenue-optimal Policy

Darius Walczak, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dwalczak@prospricing.com

Optimization in RM and Pricing is typically focused on finding revenue-optimal policies but there are business metrics that are of interest in practice such as load factor, risk, or expected demand under revenue-optimal policy. It is also important for users of a pricing system to be able to balance tradeoffs between those metrics. We present some approaches to calculate those other quantities of interest under optimal policies, both static and dynamic. We include numerical examples.

■ TA32

H-Room 504, Fifth Level

Financial Risk Measures: Properties and Extensions

Cluster: Financial Engineering
Invited Session

Chair: Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu

1 - Synthetic CDO's: Towards a Large Deviations Theory

Richard Sowers, Professor, Department of Mathematics, University of Illinois at Urbana Champai, Urbana, Il, United States of America, r-sowers@illinois.edu

We discuss rare events in a tranched pool of credit default swaps (i.e., a synthetic collateralized debt obligation). We seek to use the theory of large deviations to understand the structure of investment-grade tranches, where, by definition, the losses are rare. We indicate how the theory of large deviations can address some aspects of dynamics, heterogeneities, and correlation.

2 - Set-valued Risk Measures for Markets with Transaction Costs

Andreas Hamel, Princeton University, ORFE, Sherrerd Hall, Charlton Street, Princeton, United States of America, ahamel@princeton.edu

The notion of monetary measures of risk is extended to markets with conical transaction costs. Primal representation results are given in terms of acceptance sets. For the convex case, a dual representation theorem is proven in terms of pairs of dual variables consisting of vector probability measures and elements of the positive dual of the solvency cone. Example are given and a scalarization procedure is described which allows an effective computation of values of set-valued risk measures.

3 - A Satisficing Alternative to Prospect Theory

David Brown, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States of America, dbbrown@duke.edu, Melvyn Sim, Enrico De Giorgi

We introduce a target-based model of choice that allows decision makers to be both risk averse and risk seeking, depending on the security of a position's payoff relative to a target. This captures in spirit two celebrated ideas: the satisficing concept from Simon and the switch between risk aversion and risk seeking behaviors from prospect theory. We show that this approach is dual to that of risk measures and that it results in resolution of some of the classical paradoxes (Allais, Ellsberg).

4 - Extensions of VAR

Uma Ravat, University of Illinois at Urbana-Champaign, Urbana, Il, United States of America, ravat1@illinois.edu, Uday Shanbhag, Richard Sowers

Risk measures are important objects of modern financial theory. The theory of coherent risk measures, in particular, identifies a collection of risk measures which satisfy some natural requirements from the point of finance. While these requirements are in theory, desirable,the banking industry uses Value at Risk as its standard, which in general is not coherent. We consider the coherent extension of Value at Risk.

■ TA33

H-Room 505, Fifth Floor

Incentives in Supply Chain Design

Cluster: Economic Models in Operations Management
Invited Session

Chair: Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Harish.Krishnan@sauder.ubc.ca

1 - A Time Management Framework for Entrepreneurial Process Improvement

Onesun Yoo, PhD Candidate, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, onesun.yoo.2010@anderson.ucla.edu, Charles Corbett, Guillaume Roels

For many entrepreneurs, the main bottleneck resource of their company is their own time, rather than cash. We develop a dynamic time-management framework for entrepreneurial process improvement for contexts where time is more constrained than cash, and provide clear guiding principles for time management. We highlight the comparative statics of the optimal policy. Our model formally links time with money and introduces a framework for evaluating the opportunity cost of an entrepreneur's time.

2 - Bargaining and Contracting in Dual Format Retailing
Benny Mantin, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L3G1, Canada, bmantin@engmail.uwaterloo.ca, Harish Krishnan, Tirtha Dhar

We explore the strategic implications of dual format retailing, wherein retailers use both merchant and platform formats. While in the former the retailer buys and resell the goods, in the latter he merely offers his retailing space to other sellers for some fees. Using a bargaining framework between the retailer and an upstream manufacturer, we allow the retailer to commit to the transaction fee charged from other sellers on the platform, or set it contingent on the outcome of the bargaining.

3 - Operational Collaboration Among Competitors
Milind Sohoni, Indian School of Business, India, milind_sohoni@isb.edu, Harish Krishnan

Collaboration among competitors carries both benefits and risks. Collaborations can lower costs benefitting the firms and customers. On the other hand operational collaborations can also alter the competitive dynamics in the industry. In this paper we analyze when should firms enter into operational collaborations with competitors, and how should such collaborations be structured? We also consider the welfare implications of agreements that sustain collaboration.

4 - Cost-raising Strategies in Distribution System Design
Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Harish.Krishnan@sauder.ubc.ca, Maurice Queyranne

A manufacturer sells a product through an online retailer and a competing retailer. The online retailer has a strong "outbound" distribution network, and has to decide whether to manage its "inbound" logistics internally or to allow the manufacturer to perform this function. "Internalizing" inbound logistics impacts the costs of all firms. Therefore, even if its costs go up, the online retailer may benefit from logistics internalization because of the cost impact on its competitor.

■ TA34

H-Room 520, Fifth Floor

Disaster Preparedness and Response

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: F. Sibel Salman, Assistant Professor, Koc University, Koc University Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, ssalman@ku.edu.tr

1 - Stocking Decisions for Relief Aid
Muge Karaman, Research Assistant, Koc University, Koc University Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, mkaraman@ku.edu.tr, F. Sibel Salman

In this study,we consider stocking decisions for relief aid agencies.We present a mathematical model to determine the optimum stocking decision for agencies that stock the same commodity for their own use and work in full cooperation.The model is based on wellstudied newsvendor model but extends to incorporate the disaster risk by regarding the disaster probability and the demand distribution under a disaster.We describe the use of this approach by a real life case analysis for Istanbul,Turkey

2 - When Should a Firm Donate Excess Inventory?
Hugh Medal, Doctoral Student, Industrial Engineering Department, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hmedal@uark.edu

Because of the difficulty in predicting demand, manufacturing plants, warehouses, and retailers may end up with excess inventory. In any time period, a firm may decide to donate their excess items, dispose of them, or wait for the items to sell. Donating excess inventory is an attractive option because of the resulting tax benefits. In this presentation, we examine the decision of when a firm should donate their excess inventory.

■ TA35

H-Sapphire A, Fourth Floor

Game Theoretic Applications in Healthcare I

Sponsor: Health Applications
Sponsored Session

Chair: Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, endmuratkurt@yahoo.com

1 - Hospital Stockpiling for Influenza Pandemics with Pre-set Response Levels
Po-Ching DeLaurentis, Indiana Health Services Research Fellow, Indiana University, 410 W. 10th St., Suite 2000, Indianapolis, IN, 46202, United States of America, chenp@purdue.edu, Elodie Adida, Mark Lawley

This is a game theoretic model of hospital stockpiling of medical supplies in preparation for flu pandemics. We consider a network of hospitals with mutual aid relationships for supply sharing during a pandemic. We assume the surge demand is a function of the flu attack rate that follows a known distribution. Each hospital pre-sets its pandemic response level and decides the stockpile level that minimizes its expected overall cost.

2 - Yield Uncertainty, Information Asymmetry, and Influenza Vaccine Supply Chain Coordination
Javad Nasiry, Ph. D. Student, INSEAD, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Javad.NASIRY@insead.edu, Stephen Chick, Sameer Hasija

We model information asymmetry in the flu vaccine supply chain with yield uncertainty, and design an optimal menu of contracts that the vaccine buyer (the government) can offer to the supplier (the manufacturer) in order to induce efficiency, and produce a system optimal vaccine volume.

3 - Influenza Vaccine Supply Chain with Multiple Agencies
Hamed Mamani, Assistant Professor, University of Washington, University of Washington, Seattle, WA, 98195, United States of America, hmamani@u.washington.edu, Stephen Chick, David Simchi-Levi

The current flu vaccine supply chain presents challenges for coordinating the incentives of for-profit vaccine manufacturers and those of public-health minded governments. We show how multiple governments, each with different sensitivities to the economics of treatment, can lead to suboptimal global health outcomes if each acts in its own national interest. We also show how financial transfers can align goals of different nations and improve vaccine coverage where it is most needed.

4 - The Optimal Timing of Prearranged Paired Kidney Exchanges
Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Andrew Schaefer, M. Utku Unver, Mark S. Roberts

Paired kidney exchanges (PKE) alleviate the shortage in the supply of kidneys for transplantation. We consider the transplant timing in a PKE and formulate the resulting problem as a non-zero sum stochastic game. We present necessary and sufficient conditions to characterize the stationary equilibria of this game. We bring the equilibrium selection into focus and characterize the welfare maximizing equilibrium as an optimal solution to an MIP.

■ TA36

H-Sapphire B, Fourth Floor

Optimization of Patient Scheduling Under Uncertainty

Sponsor: Health Applications
Sponsored Session

Chair: Ayca Erdogan, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, saerdoga@ncsu.edu

1 - Optimal Daily Assignment of Surgeries to Operating Rooms
Serhat Gul, PhD Candidate, Arizona State University, Department of Industrial, Systems and, Operations Engineering, Tempe, AZ, 85281, United States of America, sgul1@asu.edu, John Fowler, Brian Denton

In this talk, we present a multi-stage stochastic programming model for the assignment of surgeries to operating rooms (OR). Each day a number of surgeries in a daily list are scheduled while the rest is canceled and transferred to the next day's surgical list. The objective is to minimize the surgery cancellation cost and the overtime cost for OR. We solve the program using a progressive hedging algorithm.

2 - Colonoscopy Scheduling with Limited Resources
Bjorn Berg, NCSU, 375 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu, Brian Denton

Colonoscopy is a cost-effective means for colorectal cancer screening. Due to the high demand and cost of operating an endoscopy suite, it is crucial that careful planning of resources and patient scheduling be done. Limited resources in the intake, procedure, and recovery areas create scheduling challenges that can lead

to system congestion. We use a discrete event simulation model to explore heuristics for scheduling an endoscopy suite under uncertainty, including the presence of no-shows.

3 - Radiation Therapy Treatment Scheduling
Antoine Saure, PhD Student, Sauder School of Business, University of British Columbia, 503-930 Seymour St., Vancouver, BC, V6B1B4, Canada, antoine.saure@sauder.ubc.ca, Martin Puterman, Jonathan Patrick

Motivated by the adverse effect of delays on patients' health such as physical distress and deterioration of quality of life, and the inefficiencies in the use of expensive resources, we develop a model for scheduling multi-priority patients into Radiation Therapy treatment units. The main purpose of this model is to allocate available capacity to incoming demand, while achieving wait time targets and increasing treatment units utilization.

■ TA37

H-Sapphire C, Fourth Floor

Capacity Investment and Pricing Decisions in Operations Management

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Ana Muriel, Associate Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, muriel@ecs.umass.edu

Co-Chair: Betul Lus, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, blus@wustl.edu

1 - Volume Flexibility with Multiple Products and the Tradeoff with Product Flexibility
Manu Goyal, Assistant Professor, Robert H. Smith School of Business, University of Maryland, mgoyal@rhsmith.umd.edu, Serguei Netessine

We analyze volume flexibility under endogenous pricing with multiple products. We prove that the value of volume flexibility is a function of demand correlation between products, an outcome which cannot be explained by classical risk-pooling arguments. Our results underscore the value and the necessity of studying volume flexibility with multiple products, and emphasize the contrast with product flexibility.

2 - A Model of Strategic Sourcing under Limited Supply
Abdullah Dasci, York University, 4700 Keele Street, Toronto, ON, M3J 2V1, Canada, dasci@yorku.ca, Kemal Guler

An economic model for a strategic buyer that faces a duopolistic upstream market will be presented. The buyer needs to procure either from two suppliers who act strategically or from a third non-strategic source. The suppliers are assumed to have limited capacities, which are the main source of strategic interactions among the firms. The problem is analyzed under simple design decisions and the impact of these decisions on firm profits and purchase prices are explored.

3 - Technology Development and Capacity Investment on Flexibility Platform
Li Jiang, Assistant Professor, Hong Kong Polytechnic University, CF 721 LMS Department, Hung Hom, Hong Kong - PRC, L.Jiang@inet.polyu.edu.hk

We consider two factors that support a manufacturing system with volume flexibility. One is the technology investment on production process that affects production cost, whereas the other is capacity investment to regulate production scale. We characterize the investments in technology and capacity, and production decisions in both a monopoly and a competitive duopoly, and study the effects of market uncertainty and competition structure.

4 - Using Product Substitution in the Design of Production Networks
Betul Lus, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, blus@wustl.edu, Ana Muriel, Stephan Biller

We investigate the benefits of producing substitutable products in different plants over producing them in the same plant. The assignment of substitutable products to different plants adds a weak flexibility link to the production system through the substitution effect, and results in reduced capacity investment levels and higher profits. The benefits increase as products become more substitutable and/or demand variability increases.

■ TA38

H-Sapphire D, Fourth Floor

Empirical Research in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, 10027, United States of America, molivares@columbia.edu

1 - Drivers of Inventory Levels at US Retailers
Sampath Rajagopalan, University of Southern California, Los Angeles, CA, 90089, United States of America srajagop@marshall.usc.edu

This study explores the impact of fundamental factors identified in the inventory literature on inventories carried by US retailers using data obtained from primary and secondary sources. We explore the impact of factors such as gross margin, product variety as measured by number of SKUs, economies of scale as measured by sales per store, demand fluctuations, etc. We find that these factors are significant in explaining retailer inventories and explain most of the variance in inventory levels.

2 - Scarcity Rents in Car Retailing: Evidence From Inventory Fluctuations at Dealerships
Jorge Silva-Risso, Associate Professor, Marketing, University of California, Riverside, 900 University Avenue, 201 Anderson Hall, Riverside, CA, 92521, United States of America, jorge.silva-risso@ucr.edu, Florian Zettelmeyer, Fiona Scott Morton

Price variation for identical cars at the same dealership is commonly assumed to arise because dealers with market power price discriminate among their customers. We show that while price discrimination may be one element, price variation also arises from inventory fluctuations, which create scarcity rents for cars that are in short supply. The price variation due to inventory fluctuations thus functions to efficiently allocate cars that are in restricted supply to customers who value them most.

3 - Does Abnormal Inventory Growth Predict Earnings of Retailers?
Saravanan Kesavan, Assistant Professor, University of North Carolina, CB #3490, McColl Building, Chapel Hill, 27516, United States of America, skesavan@unc.edu, Vidya Mani

Forecasting earnings is a key activity in financial markets. Earnings of a firm depend on, among other factors, its sales and operating expenses. In this paper we investigate if abnormal inventory growth contains useful information to predict earnings of retailers. We find that abnormal growth in inventory contains information that is predictive of future earnings and can be used to improve forecasts from time series methods as well as Wall Street analysts.

4 - Inventory Performance in the U.S. Auto Industry
Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, 10027, United States of America, molivares@columbia.edu, Gerard Cachon

In this paper, we conduct an empirical study of the main drivers of finished goods inventory performance in the US automobile industry. We find that two factors explain about 70% of the variation in inventory across manufacturers: (1) the number of dealerships; (2) production flexibility. We also explore the impact of recent segment shifts in demand on inventory performance.

■ TA39

H-Sapphire E, Fourth Floor

Models for Managing Upstream Supply Risk and Information Asymmetry

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Damian BeilAssistant Professor, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

1 - Optimal Procurement Design in the Presence of Supply Risk
Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Aadhaar Chaturvedi

This paper analyzes optimal auctions when the delivery of supply is not certain. We consider a buyer facing multiple potential suppliers, each having an associated (exogenous) risk of supply failure. We design optimal mechanisms in presence of informational asymmetry for different scenarios, dependent on the buyer's level of information regarding the suppliers' reliability.

2 - Delegating Procurement Decision under Supply Risk and Asymmetric Information
Zhibin (Ben) Yang, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, zhibiny@umich.edu, Goker Aydin, Volodymyr Babich, Damian Beil

We model the manufacturer delegating procurement to one of its two unreliable suppliers under asymmetric information. The suppliers may collaborate to fulfill the order. Compared to the direct contracting scheme, delegation may cause the manufacturer to induce less or more diversification. Consequently, the manufacturer may earn less or more profit under delegation. We further show that delegation causes these effects only if the suppliers' reliabilities are asymmetric information.

3 - Competition Under Generalized Attraction Models: Applications to Quality Competition Under Yield Uncertainty
Nan Yang, Assistant Professor, Cornell University, ny38@cornell.edu, Awi Federgruen

We characterize the equilibrium behavior in a broad class of competition models, in which the competing firms' market shares are given by an attraction model, and the aggregate sales in the industry depend on the aggregate attraction value according to a general function. While most existing competition papers with attraction models can be viewed as special cases of this general model, we apply our general results to a new set of quality competition models under yield uncertainty.

4 - Impact of Information Asymmetry on the Supply Disruption under Different Disruption Timings
Ying-Ju Chen, University of California, Berkeley, IEOR Department, Berkeley, CA, 94720, United States of America, chen@ieor.berkeley.edu, Tianhu Deng, Max Shen

In a make-to-order production system, any supply disruption happens during the production lead-time may cause the failure to deliver the products on time. In this talk, we investigate various timings of supply disruption and their impact on the supply chain performance, sourcing decisions, and risk mitigation strategies.

■ TA40

H-Sapphire H, Fourth Floor

Inventory Management of Substitutable Products

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Amr Farahat, Cornell University, 370 Sage Hall, Ithaca, NY, 14853, United States of America, aaf33@cornell.edu

1 - Assortment Planning for Vertically Differentiated Products
Dorothee Honhon, University of Texas at Austin, 1, University Station, Austin, TX, 78712, United States of America, Dorothee.Honhon@mccombs.utexas.edu, Xiajun (Amy) Pan

We consider the problem of determining the optimal assortment of vertically differentiated products. When prices are fixed, we find that the optimal assortment depends on the distribution of customer valuations. However, it is not the case when prices are decision variables. We develop effective algorithms to identify the optimal product assortment in both cases and discuss valuable insights.

2 - Robust Newsvendor Competition under Asymmetric Information
Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Houyuan Jiang, Sergei Savin

We generalize analysis of competition among newsvendors to a setting in which competitors possess asymmetric information about future demand realizations, and this information is limited to the knowledge of the support of demand distribution. We show that, contrary to the intuition, a competing newsvendor does not necessarily benefit from having better information about its demand distribution than information that competitors have.

3 - Assortment Planning: A Sensitivity Analysis
Ramnath Vaidyanathan, University of Pennsylvania, Wharton School, Philadelphia, PA, 78733, United States of America ramnathv@wharton.upenn.edu

In this paper, I explore the sensitivity of the optimal assortment and profit to the mis-specification of the choice model and ignoring stock-out substitution. I use simulations to study the sensitivity and also develop bounds on the optimality gap in terms of demand variability, in-stock rate and assortment size.

4 - The Dynamic Substitution Problem with Pricing
Amr Farahat, Cornell University, 370 Sage Hall, Ithaca, NY, 14853, United States of America, aaf33@cornell.edu, Joonkyum Lee

We study the problem faced by a centralized decision maker managing several substitutable products in a newsvendor setting. Using affine approximations to the DP problem, we investigate heuristics that perform well compared to existing approaches. These heuristics are then embedded in a larger problem that incorporates pricing under the MNL model.

■ TA41

H-Sapphire L, Fourth Floor

Joint Session SPPSN/LA/MIF: Community-Oriented Operations Research

Sponsor: Public Programs, Service, and Needs & Location Analysis Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy Public Aff, McCormack Hall 3-428A, Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu

1 - Spatial Uncertainty and Location Modeling: Implications for Sex Offender Mitigation Strategies
Tony Grubesic, Associate Professor, Indiana University, Department of Geography, Bloomington, IN, 47405, United States of America, tgrubesi@indiana.edu, Alan Murray

Residence restrictions are increasingly popular policy tools for managing the spatial distribution of sex offenders in the U.S. Often implemented with limited empirical guidance, it is likely that data uncertainty regarding sex offender locations and restriction zones within a community jeopardizes the development of effective public policies. The purpose of this paper is to examine the impacts of spatial uncertainty in the development of models to support sex offender mitigation strategies.

2 - The Stop-and-drop Problem for Food Bank Distribution
Christina Scherrer, Assistant Professor, Southern Polytechnic State University, Department of Industrial Engineering Tec, 1100 South Marietta Parkway, Marietta, GA, 30060, United States of America, cscherre@spsu.edu, Senay Solak, Ahmed Ghoniem

In the Stop-and-drop problem, donated food is delivered from a central food bank warehouse to several "drop" locations, where multiple organizations travel to pick up their food. This allows the food bank to disperse food to rural areas without sacrificing the efficiency typical to more densely populated areas. For the resulting NP-complete problem, we present decomposition based efficient solution algorithms, and provide computational results.

3 - Investigating the Effects of Partnerships on Local Public Health Agencies
Natalie Privett, PhD Candidate, Stanford University, Department of Management Science & Engin, Production & Operations Management, Stanford, CA, 94305, United States of America, nprivett@stanford.edu, Sergey Sotnikov, Gulzar Shah, Pinar Keskinocak, Feryal Erhun

Collaboration in the U.S. public health system is critical to improving public health. The expectations are that by partnering, local health departments may leverage additional financial resources for public health programs, but net effects are unclear. The principal goal of this project is to provide quantitative evaluation of the effects of partnerships on revenue generating strategies of local health departments, ultimately providing a map of optimal strategies for partnering.

4 - How Can Community-Based Practitioners Improve Planning and Operations with Management Science?
Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy Public Aff, McCormack Hall 3-428A, Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu, Felicia Sullivan, David Turcotte

Housing and community development organizations primarily serve low- and moderate income communities, designing policies and services to minimize cost and maximize service quality and social equity. Such organizations rarely use management science to help them achieve these goals. We report results of a study to provide community organizations with the opportunity to evaluate spreadsheet-based management science applications that solve problems that are central to their mission.

■ TA42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Announcement of the Wagner Prize Winner

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS
Invited Session

Chair: Allen Butler, President, Daniel H Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Wagner Prize Winner
Allen Butler, President, Daniel H Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

The winner of the 2009 Daniel H. Wagner Prize for Excellence in Operations Research Practice will be announced. The winner will then give a reprise of the previous day's presentation.

■ TA43

H-Room 400, Fourth Floor

Approximation Algorithms for Stochastic Inventory Control Problems

Cluster: Supply Chain Models
Invited Session

Chair: Retsef Levi, Assistant Professor, Sloan, School of Management, MIT, 50 Memorial Drive Building E53-389, Cambrideg, MA, 02142, United States of America, retsef@MIT.EDU

1 - Stock Optimization in Emergency Resupply Networks under Stuttering Poisson Demand
Jie Chen, Operations Research and Information Engineering, Cornell University, Rhodes Hall 257, Cornell University, Ithaca, NY, 14850, United States of America, jc562@cornell.edu, Peter Jackson, John Muckstadt

We consider a network in which field stock locations (FSL) stock multiple parts according to an (S-1,S) policy under stuttering Poisson demand. Regular replenishment occurs from a regional stock location with unlimited supply. Demand in excess of inventory at a FSL is routed to an emergency stock location (ESL). We focus on the problem of determining the best stock levels at the FSLs and ESL to minimize holding, backorder, and emergency resupply costs subject to a network budget constraint.

2 - Near-Optimal Algorithms for Assortment Planning under Dynamic Substitution and Stochastic Demand
Vineet Goyal, Postdoctoral Associate, MIT, 77 Massachusetts Ave, E40-111, Cambridge, MA, 02139, United States of America, goyalv@MIT.EDU, Retsef Levi, Danny Segev

We consider a single-period assortment planning problem under a dynamic-substitution model with stochastic demand and give a polynomial time approximation scheme (PTAS) for the problem under fairly general assumptions that computes a near-optimal assortment with only a constant (depending only on the accuracy level) number of product types. We also present several complexity results for the problem that indicate that our assumptions are almost 'necessary' to solve it efficiently.

3 - Approximation Algorithms for Stochastic Lot-sizing Inventory Control Models
Cong Shi, PhD Candidate, Massachusetts Institute of Technology, Apt 396C, 70 Pacific St, Cambridge, MA, 02139, United States of America, shicong@MIT.EDU, Retsef Levi

We develop new algorithmic approaches to compute provably near-optimal policies for multiperiod stochastic lot-sizing inventory models with stochastic, non-stationary and correlated demands that evolve over time. This is one of the core models in inventory theory that has challenged researchers and practitioners for several decades. These policies that we develop have worst-case performance guarantees and perform very close to optimal in computational experiments.

4 - A Constant Approximation Algorithm for the *a Priori* TSP
David Shmoys, Professor, Cornell University, 231 Rhodes Hall, Hoy Road, Ithaca, NY, 14853, United States of America, shmoys@cs.cornell.edu, Kunal Talwar

For the TSP, we seek a tour T of a set N to minimize its total length c(T). In the a priori TSP, there also is a probability dist. P over subsets of N. A tour T induces a tour T(A) of length c(T(A)) for a subset A by omitting the points not in A. The value of an a priori tour T is its expected length w.r.t a random choice of A drawn according to P, E[c(T(A))]; we seek a T to minimize this. We give constant approx. alg. if P is specified by an independent activation prob. p(j) for each j in N.

■ TA44

H-Room 402, Fourth Floor

Educating Students in Service Sciences Panel Session

Sponsor: Service Science
Sponsored Session

Chair: Leonard Bohmann, Associate Dean of Engineering, Michigan Tech, 712 Minerals & Materials Engn Bldg, 1400 Townsend Dr., Houghton, MI, 49931, United States of America, ljbohman@mtu.edu

1 - Educating Students in Service Sciences
Leonard Bohmann, Associate Dean of Engineering, Michigan Tech, 712 Minerals & Materials Engn Bldg, 1400 Townsend Dr., Houghton, MI, 49931, United States of America, ljbohman@mtu.edu, Lou Freund, John McCreery

The panel will introduce the educational programs for educating students in service sciences that are presently in place at three US universities; Michigan Tech, North Carolina State, and San Jose State Universities. Although each program has its own focus, all three involve a collaboration between Business and Engineering. A discussion will follow on curriculum, program organization, and industry interactions.

2 - MS in ISE - Service Systems Engineering with Six Sigma Black Belt Option
Lou Freund, Professor and Chair, Department of Industrial & Systems Engineering, San Jose State University, 1 Washington Square, San Jose, CA, 95192-0085, United States of America, louis.freund@sjsu.edu

We have recently created an interdisciplinary emphasis area in our MS in ISE degree program that enables students to focus on Service Systems Engineering. An added feature is an option to obtain a Black Belt in Service Quality. This presentation will outline the program structure and prerequisites.

■ TA45

H-Room 410, Fouth Floor

Strategies for Managing Incremental and/or Radical Innovation

Cluster: New Product Development
Invited Session

Chair: Raul Chao, Darden Graduate School of Business, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, chaor@darden.virginia.edu

1 - Connecting Industry to Science
Bruno Cassiman, IESE Business School and KULeuven, Avenida Pearson 21, Barcelona, Spain, bcassiman@iese.edu, Reinhilde Veugelers, Sam Arts

The paper studies the role of IMEC, a world leading independent research institute in the area of nanotechnology, as a bridge between science and industry. Our patent dataset defining the span of IMEC consists of more than 20,000 unique inventors and 4,500 unique applicants, including around 2,300 companies, 100 universities and 100 research centers. We examine the underlying mechanisms through which such industry-science links affect the innovation performance of organizations and inventors.

2 - Beyond Ambidexterity: Understanding the Balance between Exploration and Exploitation
Drew Hess, University of Virginia, P.O. Box 400173, Charlottesville, VA, United States of America, hess@virginia.edu, Sam Ransbotham

It is established that innovation requires ambidexterity -balancing exploration and exploitation. We move beyond the question of whether ambidexterity is important and instead focus on understanding this balance. Although the term balance implies an even ratio of exploratory to exploitive projects,it is unlikely that an even ratio is optimal. We examine the composition of this ratio and the patterns of firm exploration and exploitation choices by analyzing 34K projects in the pharma industry.

3 - The Big Picture: Exploring the Performance Implications of Being at the Technological Frontier
Om Narasimhan, University of Minnesota, 321 19th Ave. South, Minneapolis, United States of America, naras002@umn.edu, Prokriti Mukherji, Madhu Viswanathan, Rajesh Chandy

We examine the performance impact of operating at the technological frontier in high-tech markets, and how firms' decisions to outsource core technologies impacts the likelihood of being at the frontier. We address these issues in the context of the digital television industry in the North American, Japanese, and European markets.

4 - Organization Structure, Incentives, and the Innovation Portfolio
Raul Chao, Darden Graduate School of Business, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, chaor@darden.virginia.edu, Stylianos Kavadias

In an attempt to deliver significant growth beyond the near term, many organizations have turned to grassroots innovation - bottom-up processes that access the ideas of all employees in the organization. Institutionalizing grassroots innovation is difficult because it requires interaction between employees that span the entire breadth and depth of the organization. In this study we explore the organization structures and incentives that help or hinder grassroots innovation initiatives.

■ TA46

H-Room 411, Fourth Floor

Modularity in Business Models, Processes and Logistics

Sponsor: Technology Management
Sponsored Session

Chair: Anu Bask, Senior Advisor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, anu.bask@hse.fi

1 - Modular Business Models in Logistics
Mervi Rajahonka, Researcher, Helsinki School fo Economics, POB 1210, Helsinki, 00101, Finland, mervi.rajahonka@hse.fi, Anu Bask, Markku Tinnila

This paper looks at business models based on modular service structures at logistics service providers. Business models have become a tool for developing services with novel earning models, service channels and service processes. We believe that modularity in business models can solve many of the development challenges and offer service flexibility. The findings show that modularity approach provides a background for development of service offerings, business models and processes.

2 - Intellectual Capital or Intellectual Property: Which is More Important for Regional Economic Development?
Nitin Mayande, Portland State University, Charles Weber

A comprehensive analysis of US patent data from 1995 to 2005 suggests that wealth (as measured by GDP per capita) of (US) states increasingly depends upon the density of of intellectual property rather than the density of intellectual capital. Attracting corporate headquarters to a region contributes significantly to regional prosperity. The study identifies clear winners and losers among US states.

3 - Modular Business Processes in Financial Services
Thomas Frandsen, Ph.D. Fellow, Copenhagen Business School, Solbjerg Plads 3 B5.19, 2000 Frederiksberg, Denmark, tfr.om@cbs.dk

The principles of modularity have become increasingly important for the design of flexible business process architectures. A central question is how modular processes are developed and used to realize the benefits of flexibility. This paper investigates the development and reuse of standardized process components within the context of a financial service provider. Of particular interest are the consequences of modular process architecture on transaction characteristics and firm capabilities.

4 - Modular Service Structures: Case E-business Logistics
Mervi Lipponen, Researcher, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, mervi.lipponen@hse.fi, Markku Tinnila, Anu Bask

In the past years, continuous progress in e-commerce has taken place. Logistics has proved to be an important factor in implementing e-commerce. Consequently, this paper discusses the effects of the Internet sales channel on the physical delivery of goods and brings up features in logistics structures that are specific to e-commerce. Our special interest is on changes in service structures and logistics business models as well as opportunities of modularity and related technological solutions.

■ TA47

H-Room 412, Fourth Floor

New Frontiers in Global Sourcing

Cluster: Global Sourcing of Services
Invited Session

Chair: Natalia Levina, Associate Professor, NYU, Kaufman Management Center, 44 West 4th Street, Room 8-78, New York, NY, 10012, United States of America, nlevina@stern.nyu.edu

1 - Drivers Of Output Quality In Offshore Outsourcing: Evidence From Field Research
Ravi Aron, Assistan Professor, John Hopkins University, The Carey Business School, 100 N. Charles St. Room 11-15, Baltimore, MD, 21201, United States of America, raviaron@jhu.edu, Praveen Pathak, Ying Liu

We investigate how inter-organizational monitoring mechanisms (information systems) complement the use of contractual mechanisms such as penalties and incentives to deliver optimal output quality in the offshore outsourcing of services. We also explore how work structure, contractual clauses and monitoring across boundaries of the firm interact over time to produce to quality outcomes. Our analysis is based on extensive data collected in field research.

2 - Redefining Organizational Boundaries? The Outsourcing of Core Innovation Activities
Saikat Chaudhuri, Assistant Professor of Management, The Wharton School, University of Pennsylvania, 2029 Steinberg Hall-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA, 19104-6370, United States of America, saikatc@wharton.upenn.edu, Phanish Puranam

The rise of outsourcing calls into question traditional notions of firm boundaries, as core tasks are increasingly performed by external vendors. This paper sheds light on the so emerging disaggregated organization, by examining the performance effects of challenges and management of global R&D projects conducted by a leading Indian outsourcing provider with its clients. The findings enhance our understanding of the evolving modern firm, outsourcing implementation, and innovation management.

3 - Services Nearshoring: An Empirical Perspective on Location Determinants
Eugene Hahn, Associate Professor, Salisbury University, 1101 Camden Ave., Salisbury, MD, 21801, United States of America, edhahn@salisbury.edu, Kraiwinee Bunyaratavej

While academic research involving services offshoring has increased, little empirical research has explored the sourcing alternative of nearshoring, despite the fact that firms situate about one out of five projects abroad in a nearshore location. We find that risk and service skill level influence firm decision-making regarding services offshoring location choices, and that the factors that drive nearshoring are qualitatively different than those that influence offshoring.

■ TA48

H-Sapphire Green Room, Fourth

Service Design and Strategy

Cluster: Service Operations Management
Invited Session

Chair: Liana Victorino, University of Victoria, P.O. Box 1700 STN CSC, Victoria, BC, V8W 2Y2, Canada, lianav@uvic.ca

1 - Strategic Priorities in Service Operations: Speed-quality Trade-off
Hongsuk Yang, Seoul National University, 599 Gwanangno Gwanak-gu, Seoul, 151-916, Korea, Republic of, hongsuk@snu.ac.kr, Sangwook Park, Dahyoun Park

There were numerous studies attempting to classify services and propose service operations strategies. Many of them claimed the trade-off between cost and flexibility in services. In this study, we propose time and quality trade-off in service operations strategy using service product/process matrix. This will help service firms enhance their understanding of service features and better develop an operations strategy.

2 - Exploring Consumer Reactions to Tipping Guidelines: Implications for Service Quality
Ekaterina Karniouchina, Assistant Professor of Marketing, Chapman University, One University Drive, Orange, CA, 92866, United States of America, karniouc@chapman.edu, Rohit Verma, Himanshu Mishra

This experimental study looks at the relative effectiveness of gratuity guidelines that are used by the restaurants in order to encourage the patrons to be more generous with the wait staff. The results indicate that service quality moderates the influence of tipping guidelines on resulting gratuity.

3 - Investigating Behavioral Sequence Effects into Large Scale Scheduling Problems
Michael Dixon, PhD Candidate, Cornell University, G-80 Statler Hall, Ithaca, NY, 14853, United States of America, mjd295@cornell.edu, Rohit Verma

OM scholars have recently begun to investigate the relationship of human behavior and operations decisions. In this study we begin to incorporate past behavioral research findings into large scale planning and scheduling problems. Using a unique archival data source provided by a renowned performing arts venue, we propose strategy to schedule events in such a way that incorporates peak and end effects in order to improve repurchase of season subscriptions.

■ TA49

H-Room 300, Third Floor

Contingent Efficiency of Global Supply Chain and Logistics

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: John Liu, Chair Professor of Maritime Studies, The Hong Kong Polytechnic University, Department of Logistics and Maritime Studies, Hung Hom, TST, Kowloon, Hong Kong - PRC, lgtjliu@polyu.edu.hk

1 - Computational Characteristics of Degenerate Production Frontier
Jianfeng Mao, The Hong Kong Polytechnic University, The Hong Kong Polytechnic University, Hong Kong, Hong Kong - ROC, maoeco@live.com, John Liu

This paper is concerned with computational optimization of nonsmooth production frontier with degenerative inputs, an active research topic that arises from contingent situations, such as the financial crisis of 2008, where economic growth and production outputs usually evolve through nonsmooth paths due to inevitable discrete choices and contingent changes in certain input factors. An efficient method is developed for nonsmooth frontier analysis based on the separability of degenerative inputs.

2 - Inventory Control with Uncertainty Supply and Fixed Setup Cost
Yunzeng Wang, Dr., University of California Riverside, 900 University Avenue, Riverside, CA, United States of America, yunzeng.wang@ucr.edu, Song Yuyue

We consider the basic single item single location inventory control problem with random yield. In the literature, the common assumption for this type of systems is zero fixed setup cost for any replenishment. In this work, we will investigate the impact of positive fixed setup cost on the optimal inventory control policy.

3 - Regular-impulse Stochastic Control in Financial/Insurance Optimization Models
Jiguang (Laser) Yuan, PhD Candidate, Hong Kong PolyU, Department of Logistics and Maritime Stu, Hong Kong - PRC, laser.yuan@gmail.com, Michael Taksar

We consider a diffusion dividend optimization model for an insurance company, which can control the risk via reinsurance. The payment of dividends is subject to taxation and in addition there is a set-up cost of K is incurred. The objective is to maximize the present value of the dividends payments until the time of bankruptcy. We show how to solve this problem via regular-impulse control and show how the optimal policy depends on the parameters of the model.

4 - Dual Sourcing in Managing Supply Chain Risks
Ping Su, SUNY New Paltz, One Hawk Drive, New Paltz, NY, 12561, United States of America, sup@newpaltz.edu, Shuguang Liu

We study a global firm that operates two supply sites, each with its own supply process. The domestic site is an established site that has steady growth and more expensive. The foreign site is cheaper and has an evolving supply process, which is subject to both supply disruption risk and operational risks. We find the optimal allocation of capability between the two sites. Our results show that under certain utility functions the optimal allocation is independent of time.

5 - Transitional Efficiency: Dynamic Frontier under Controllable Inputs
John Liu, Chair Professor of Maritime Studies, The Hong Kong Polytechnic University, Department of Logistics and Maritime Studies, Hung Hom, TST, Kowloon, Hong Kong - PRC, lgtjliu@polyu.edu.hk, Xuesong Li

Facing contingent events such as the financial crisis of 2008, contingent measures are often introduced to establish a new steady state in the shortest possible time. Noting production frontier as a primary measure of steady-state efficiency, this paper registers a novel attempt to develop a dynamic frontier model of differential mixed variational inequality (DMVI) for transitional efficiency analysis.

■ TA50

H-Room 302, Third Floor

Sports and Entertainment

Contributed Session

Chair: John Kros, Associate Professor, East Carolina University, 3121 Bate Building, Greenville, NC, 27858, United States of America, krosj@ecu.edu

1 - Modeling a Tennis Ladder to Demonstrate Social versus Aggressive Competitive Behavior
Kellie Keeling, Assistant Professor, University of Denver, DCB Department of Statistics, MSC 8952, 2101 S. University Blvd., Denver, CO, 80208-8952, United States of America, kkeeling@du.edu, Tom Obremski

Tennis ladders are used by tennis facilities to encourage competition among players with relatively like skills.† We present a tennis ladder simulation model, created in order to examine the ability of aggressive, neutral, and non-aggressive players to advance over the course of the competition.† Applicability to business career development will be discussed.

2 - Scaling the House: Optimal Zoning for the Entertainment Venue
Naragain Phumchusri, PhD student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, naragain@gatech.edu, Julie Swann

In the entertainment venue, front seats are usually priced higher than those located further away since they provide closer views of the show. One of the decisions the venue's management needs to make is how to optimally scale the house. We study the optimal zoning decision when the demand function is affected by the distance from the stage. We characterize the decisions under different scenarios and examine the effects of price and distance sensitivity.

3 - Home Field Advantage in College Football: Some Perspectives
John Kros, Associate Professor, East Carolina University, 3121 Bate Building, Greenville, NC, 27858, United States of America, krosj@ecu.edu, Christopher Keller

Home field advantage in college football is estimated as 3/4 points. This estimate may be biased since individual teams have some control over selection/scheduling of their opponents. In order to account for this possible bias, this paper analyzes game results from continuous long running rivalries (CLR). There are 120 FBS teams; 79 teams have at least one CLR, and there are 105 CLR's as of the 2008 season. The home field advantage for CLR's is less than the common estimates of 3/4 points.

■ TA51

H-Room 303, Third Floor

Integer Programming

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu

1 - Lead Time Considerations for the Multi-Level Capacitated Lot-sizing Problem
Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Christian Almeder, Bernardo Almada Lobo

We study the multi-level capacitated lot-sizing problem with lead time where in each time period production needs to be scheduled on several machines. Two mixed integer programming models are proposed, which are solved by various solution methodologies.

2 - A Polyhedral Study of Lot-sizing with Supplier Selection
Yijia Zhao, University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States of America, yz4k@virginia.edu, Diego Klabjan

The standard economic lot-sizing problem assumes a single supplier is available. We study the problem with several suppliers each one of them exhibiting economies of scale. A complete polyhedral description of the uncapacitated case is provided. For the capacitated case, we propose a family of valid inequalities derived from standard lot-sizing and single node fixed charge problems.

3 - Solution Strategies for Dense MIPs
Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu, Vishal Surana

In this talk, we will first present theoretical results of approximation algorithms for dense MIP marketshare instances. These approximation algorithms produce very tight bounds in reference to the optimal solutions. Solution strategies for solving some of these dense MIP instances through cutting plane techniques will be discussed.

4 - Exact Sequential Simultaneous Up Lifting in Binary Knapsack Polytopes
Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu, Lauren Kubik

This talk describes how to perform exact sequential simultaneous up lifting of an arbitrary number of sets on the binary knapsack polytope. Both polynomial time and psuedo-polynomial time algorithms are presented. Some facet defining conditions are presented along with examples and a small computational study.

■ TA52

H-Room 304, Third Floor

Strategic Models of Marketing and Operations Interface

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Baris Ata, Professor, Northwestern University, MEDS Dept - Kellogg School of Management, 2001 Sheridan Road, Evanston, ID, 60208, b-ata@kellogg.northwestern.edu

Co-Chair: Canan Savaskan, Northwestern University, Kellogg Graduate School of Management, 2001 Sheridan Road / Leverone Hall, Evanston, IL, r-savaskan@kellogg.northwestern.edu

1 - Decentralizing Price and Lead-time Decisions under Competition
Pelin Pekgun, Solution Architect, OR, JDA Software Group, 1090 Northchase Pkwy, Suite 300, Marietta, GA, 30067, United States of America, pelin.pekgun@jda.com, Paul Griffin, Pinar Keskinocak

We study the impact of the decentralization of price and lead-time decisions as quoted by marketing and production, respectively, in a duopoly. We find that when the price competition in the market is less intense than lead-time competition, a decentralized strategy may dominate a centralized one. However, under intense price competition, firms may suffer from a decentralized strategy especially under high capacity. We also discuss cases when one or both firms may need to leave the market.

2 - Measuring Seat Value in Theaters
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Ramnath Vaidyanathan

We study how the ex-post seat value perceived by a patron attending an event in a theater/stadium drives his/her future willingness to pay. Using a proprietary dataset, we develop an empirical model quantifying the impact of increased satisfaction on a patron's future willingness to pay, controlling for customer attribute and seat location characteristics, to understand the linkage between RM and customer satisfaction for experience goods/services.

3 - A Revenue Management Approach to Improve Profitability of Remanufacturable Products
Canan Savaskan, Northwestern University, Kellogg Graduate School of Management, 2001 Sheridan Road / Leverone Hall, Evanston, IL, r-savaskan@kellogg.northwestern.edu, Mustafa Akan, Baris Ata

In this paper, we discuss ways in which revenue management concepts can be used to improve profitability of remanufacturable products.

■ TA53

H-Room 305, Third Floor

Advancements in Theory of Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Kiavash Kianfar, Assistant Professor, Texas A&M University, 239B Zachry, TAMU 3131, College Station, TX, 77843, United States of America, kianfar@tamu.edu

1 - Knapsack Cryptosystems Based on Recurrence Sequences
Bala Krishnamoorthy, Washington State University, Pullman, WA, United States of America, kbala@wsu.edu, William Webb, Nathan Moyer

Traditional knapsack cryptosystems are suspect to attacks using basis reduction (BR), or BR followed by integer programming (IP). We consider new constructions for knapsack cryptosystems based on recurrence sequences. The choice of each number in the representation of the message depends on the residue class of the previous number. Representation of these relations as linear inequalities results in impractically large numbers of constraints, thus making BR and IP attacks ineffective.

2 - Utilizing Partial Objective Function Inequalities for the Multi-item Capacitated Lot-sizing Problem
Esra Buyuktahtakin, Visiting Assistant Professor, University of Arizona, 1127 E. James E. Rogers Way, Engineering Building #20, Tucson, AZ, 85721, United States of America, esra@sie.arizona.edu, Joseph Hartman, Cole Smith

We derive valid inequalities based on the partial objective function of the multi-item capacitated lot-sizing problem (MCLSP) formulation. We then develop algorithms to strengthen these inequalities by employing lifting procedures. The inequalities can be utilized in a cutting-plane strategy, in which we perturb the partial objective function coefficients to identify violated inequalities to the MCLSP polytope. We also present computational experiments with the proposed valid inequalities.

3 - The Stochastic Lot-sizing Problems with Deterministic Demands and Wagner-Whitin Costs
Zhili Zhou, University of Florida, 303 Weil Hall Industrial and Systems Engineering, Gainesville, FL, 32611, United States of America, zlzhou@ufl.edu, Yongpei Guan

In this talk, stochastic lot-sizing problems with deterministic demands and Wagner-Within costs are considered. We examine properties for the optimal inventory and backlogging levels. We provide extended linear programming formulations to describe the integral polyhedral for the single-item uncapacitated case (SULS) and the single-item uncapacitated case with backlogging (SULSB) respectively, regardless of the scenario tree structure.

4 - Facet-defining Properties of N-step Mingling Inequalities for Mixed-integer Knapsack Sets
Kiavash Kianfar, Assistant Professor, Texas A&M University, 239B Zachry, TAMU 3131, College Station, TX, 77843, United States of America, kianfar@tamu.edu, Alper Atamturk

We show that the n-step mingling inequalities are facet-defining for mixed-integer knapsack sets if certain conditions on coefficients are satisfied (the facet-defining conditions for mingling and 2-step mingling inequalities are special cases of these conditions). This makes n-step mingling a novel method for generating facets for the general mixed-integer knapsack set, and presents new facets for this set.

■ TA54

H-Room 306A, Third Floor

Network Problems in Embedded Graphs

Sponsor: Optimization/Networks
Sponsored Session

Chair: Glencora Borradaile, Oregon State University, Corvallis, OR, United States of America, glencora@eecs.oregonstate.edu

1 - Homology Flows, Cohomology Cuts
Amir Nayyeri, University of Illinois at Urbana Champaign, 201. N. Goodwin, Urbana, United States of America, nayyeri2@uiuc.edu, Erin Wolf Chambers, Jeff Erickson

We describe the first algorithms to compute Maximum flows in surface-embedded graphs in near-linear time. Given an undirected graph embedded on an orientable surface of genus g, with two specified vertices s and t, our algorithm computes a maximum (s,t)-flow in in $O(g^7 n \log^2n \log^2C)$ time for integer capacities that sum to C, or in $(g \log n)^O(g) n$ time for real capacities. Except for the special case of planar graphs, for which an $O(n \log n)$-time algorithm has been known for 20 years, the best previous time bounds for maximum flows in surface-embedded graphs follow from algorithms for general sparse graphs. Our key insight is to optimize the relative homology class of the flow, rather than directly optimizing the flow itself. A dual formulation of our algorithm computes the minimum-cost cycle or circulation in a given (real or integer) homology class.

2 - Minimum Cuts and Shortest Homologous Cycles
Erin Wolf Chambers, Assistant Professor, St. Louis University, Department of Mathematics and Computer S, 220 N. Grand Blvd., St. Louis, MO, 63103, echambe5@slu.edu, Jeff Erickson, Amir Nayyeri

We describe the first algorithms to compute minimum cuts in surface-embedded graphs in near-linear time. Given an undirected graph embedded on an orientable surface of genus g, with two specified vertices s and t, our algorithm computes a minimum (s,t)-cut in g^{O(g)} n log n time. Except for the special case of planar graphs, the best previous time bounds for finding minimum cuts in embedded graphs follow from algorithms for general sparse graphs.

3 - Studying (non-planar) Road Networks Through an Algorithmic Lens
David Eppstein, Professor, University of California, Irvine, Department of Computer Science, Bren Hall, Irvine, CA, 92697, United States of America, david.eppstein@gmail.com, Michael T. Goodrich

We study the geometric graph properties of road networks, focusing on properties that can be exploited in the design of fast algorithms. Unlike previous approaches, we do not assume that road networks are planar graphs; empirically, road networks are quite non-planar. Instead we formalize these networks as "multiscale-dispersed graphs" via disk neighborhood systems. This approach leads to fast algorithms for shortest paths and Voronoi diagrams without assumptions about the edge weights.

4 - Network Sketching: How Much Geometry Hides in Connectivity
Nikola Milosavljevic, Ph.D. Candidate, Stanford University, 318 Campus Drive, Clark Center S257, Stanford, CA, 94305, United States of America, nikolam@stanford.edu, Stefan Funke

We consider a wireless sensor network deployed on a flat terrain and ask how much of its unknown geometric layout can be recovered if the only available information are pairs of nodes than can communicate. We show how to extract a "network sketch" — a planar subnetwork whose faces capture "network holes" (areas with no nodes), and whose planar embedding yields "virtual coordinates" for location-based sensor network protocols.

■ TA55

H-Room 306B, Third Floor

Covering Problems and Applications

Contributed Session

Chair: Alex Zhang, HP, 1501 Page Mill Road, M/S 1140, Palo Alto, CA, 94304, United States of America, alex.zhang@hp.com

1 - An Improved Greedy Algorithm for the Set Covering
Amnon Gonen, Dean, Management of Technolgy Faculty, Holon Institute of Technology, 52 Golomb St., Holon, Israel, agonen@hit.ac.il, Tzahi Avrahami

In this study we have to cover N sites by allocating minimum number of servers. Each server covers a predefined pattern and by locating it to a site K it covers its neighbors according to its pattern. The most common family of heuristic algorithms to the set covering problem is the Greedy type algorithms. The following study compares an Improved Heuristic Algorithm (IHA) with the Greedy one. The results showed that in most cases, for symmetric severs, the IHA finds better solutions.

2 - Approximation of the Capacitated Set Cover Problem with Splittable Demands
Myoung-Ju Park, Seoul National University, San 56-1 Shilim-Dong, Kwanahk Gu, Seoul, 151-742, Korea, Republic of, pmj0684@snu.ac.kr, Sung-Pil Hong

The capacitated set cover problem consists of a set of items and a collection of sets of items. Each item has a demand which can be split into the sets that contain it. We can use multiple copies of each and each copy can cover a total demand at most 1 with some cost. The goal is to find a minimum cost capacitated set cover. This paper will suggest a 1+H_k approximation algorithm when the cost of set is equal to each other, and a 2H_k approximation algorithm, otherwise, where H_k=1+1/2+...+1/k.

3 - Covering Path Problem with New Elements and Heuristics
Liyan Hua, PhD Student, Ohio State University, 600 Fisher Hall, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hua_20@fisher.osu.edu, David Schilling, John Current

We introduce facility capacity constraints to the maximum covering/shortest path problem. The problem is decomposed into a k-shortest path problem and a capacitated maximum covering problem. The k-sp problem is solved by a path deletion algorithm. The capacitated maximum covering problem is solved by various meta-heuristics including Tabu search and simulated annealing. These meta-heuristics are compared with each other and with previous approaches to the capacitated maximum covering problem.

4 - Supplier Consolidation Using Capacitated Set Covering
Alex Zhang, HP, 1501 Page Mill Road, M/S 1140, Palo Alto, CA, 94304, United States of America, alex.zhang@hp.com, Shailendra Jain, Jerry Shan, Cipriano Santos, Jose Luis Beltran

We present a method for identifying suppliers, among a large list of suppliers with whom an enterprise (such as HP) has done business with in the past, for supplier base consolidation. Further, when unit cost data of each supplier is available, we solve the problem of selecting suppliers to minimize the total procurement cost. We extend the classic set covering problem to capacitated set covering. Our method allows considerations of supplier capacity and supplier share limit.

■ TA56

H-Room 307, Third Floor

Methods for Large-Scale Nonlinear Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Philip Gill, Professor, University of California, San Diego, 9500 Gilman Drive, # 0112, La Jolla, CA, 92093-0112, United States of America, pgill@ucsd.edu

1 - Solution of a Stochastic Model for Allocation of On-line Advertising Inventory
John Tomlin, Yahoo! Labs, 701 First Avenue, Sunnyvale, CA, 94089, United States of America, tomlin@yahoo-inc.com, Vijay Bharadwaj, MIchael Saunders

We describe the stochastic extension of a transportation model with separable convex objective for optimal allocation of online advertising inventory for guaranteed delivery. Using the approach pioneered by Beale and Dantzig, we arrive at a stochastic model that is also convex and separable. We apply a C++ version of the primal-dual interior solver PDCO.

2 - An Interior-point Trust-funnel Algorithm for Large-scale Nonconvex Optimization
Daniel Robinson, Oxford University, Wolfson Building, Parks Road, Oxford, OX1 3QD, United Kingdom, daniel.p.robinson@gmail.com, Nick Gould, Philippe Toint

We discuss an interior-point trust-funnel algorithm for large-scale nonconvex optimization. Global convergence of our method is ensured by trust-region methodology combined with the so-called ``funnel". The prominent features of our algorithm are that each subproblem may be solved approximately and that inexact SQP steps may be computed when deemed advantageous during the course of solving each barrier subproblem.

3 - SQP Methods for Nonlinear Optimization
Philip Gill, Professor, University of California, San Diego, 9500 Gilman Drive, # 0112, La Jolla, CA, 92093-0112, United States of America, pgill@ucsd.edu, Elizabeth Wong

We consider the formulation and analysis of sequential quadratic programming (SQP) methods for large-scale nonlinearly constrained optimization that may be ``hot started" from a good approximate solution. In this context we focus on SQP methods that are best able to use ``black-box" linear algebra software. Such methods provide an effective way of exploiting recent advances in linear algebra software for multicore and GPU-based computer architectures.

■ TA57

H-Room 308, Third Floor

Application of System Tools to Healthcare Engineering

Sponsor: Health Applications
Sponsored Session

Chair: Tze Chiam, PhD Candidate, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States of America, tzechao@purdue.edu

1 - Modelling the Future of the Canadian Cardiac Surgery Workforce
Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca, Sonya Vanderby

Corresponding to an increased use of non-surgical interventions, cardiac surgery rates have been declining in recent years. This reduction has affected job prospects for new grads, deterring current medical students from selecting the specialty. Reduced enrolment, coupled with the aging of both current cardiac surgeons and the general population is raising concerns about potential future shortages. Using system dynamics, we developed a simulation of the supply and demand for cardiac surgeons.

2 - A Bayesian Approach for Scheduling Low-acuity Patient in the Emergency Department
Shengyong Wang, Assistant Professor, The University of Akron, Mechanical Engineering Department, ASEC Room 101, Akron, OH, 44325-3903, United States of America, wangs@uakron.edu

Traditionally, Emergency Department (ED) does not operate based on appointments. While most low-acuity patients experience prolonged waiting time before being seen by a physician, mainly due to bed availability, they have some flexibility on their arrival time to the ED. Aiming at creating a balanced system and improving the patients' experience at the ED, a Bayesian model combining historical trends and real-time information was established to schedule low-acuity patients at ED.

3 - Optimizing Organ Procurement Coordinator Decision Making
Gozde Icten, University of Pittsburgh, zgi1@pitt.edu, Lisa Maillart

A ranked match list is generated for a donated liver and a coordinator aims to place the organ with a recipient as quickly as possible by proceeding down the list. The coordinator controls the number of simultaneous offers extended, and may resort to expedited placement if the process becomes lengthy. We model the coordinator's decisions as an MDP and perform both structural and numerical analysis.

4 - Placing Expedited Livers
Zeynep Erkin, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, zee2@pitt.edu, Lisa Maillart

To expedite organ placement, some livers (after proceeding through the standard match process for some time) are offered not to another individual patient, but rather to a transplant center. The center must then decide which, if any, of its patients should receive the organ, which involves a tradeoff between accepting an organ of relatively low quality versus waiting for potential future offers. We model and analyze this sensitive resource allocation problem as a large-scale average reward MDP.

■ TA58

H-Room 309, Third Floor

Resource Allocation and Logistics Problems

Cluster: Scheduling
Invited Session

Chair: Nicholas Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall.33@osu.edu

1 - Container Scheduling Problem
Kangbok Lee, Postdoc, New York University, Department Information, Operat and Management, 44 W. 4th ST, New York, NY, 10012, United States of America, klee3@stern.nyu.edu, Byung Cheon Choi, Joseph Y-T Leung, Michael L. Pinedo, Dirk Briskorn

We consider the problem of shipping containers from their origination ports to their destination ports. Ships have capacities and fixed routing schedules and each ship visits a number of ports. The goal is to assign containers to ships in order to optimize certain objectives related to completion times and due dates. We discuss the computational complexity of the problem and analyze some heuristics.

2 - Allocation of Jobs and Resources to Work Centers
Hui-Chih Hung, National University of Singapore, 1 Engineering Drive 2, Singapore, hhc43212@gmail.com, Marc Posner

We study a stochastic resource allocation problem where non-identical servers are partitioned into parallel work centers, and simultaneously job types are assigned to the centers. Each job type has a distinct Poisson arrival rate and WIP weight. The goal is to minimize total WIP cost. Heuristics are constructed for random and fastest available server assignment disciplines. Theoretical bounds are developed and heuristic performance is empirically evaluated.

3 - On the Container Vessel Scheduling with Time Window Constraints
Selim Bora, Rutgers University, NJ, United States of America, selimbora@gmail.com, Kristina Sharypova, Lei Lei

We consider the minimum-cost vessel scheduling problem involving many ports and time window constraints on vessel arrivals. In addition to the demand on cargo containers, each port has also a positive/negative demand on empty containers. We solve a special case by dynamic programming, and introduce a new greedy algorithm for the general cases.

■ TA59

H-Room 310, Third Floor

Tutorial: New Sphere Methods for LP

Cluster: Tutorials
Invited Session

Chair: Katta G. Murty, Professor, University of Michigan, Department of IOE, 1205 Beal Avenue, Ann Arbor, Mi, 48109-2117, United States of America, murty@umich.edu

1 - New Sphere Methods for LP
Katta G. Murty, Professor, University of Michigan, Department of IOE, 1205 Beal Avenue, Ann Arbor, Mi, 48109-2117, United States of America, murty@umich.edu

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

■ TA60

H-Room 311, Third Floor

Extensions and Applications of Linear and Cone Programming

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

1 - Gradient Based Method for Cone Programming and Applications
Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, Canada, zhaosong@sfu.ca

We consider four natural primal-dual convex smooth minimization reformulations for cone program (CP), and discuss a variant of Nesterov's smooth (VNS) method for solving them. The associated worst-case arithmetic operations costs of the VNS method for them are estimated and compared. We show that for a class of CPs, the VNS method based on the last one generally outperforms the others. Finally, we discuss some application to MAXCUT, Lovasz capacity, and compressed sensing.

2 - Interior-Point Methods for Mixed-Integer Nonlinear and Cone Programming Problems
Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu, Vivek Mahanta

In this talk, we will present details of an interior-point method for solving the nonlinear, second-order cone, and semidefinite programming subproblems that arise in the solution of mixed-integer optimization problems. Of particular concern will be warmstart strategies and infeasibility identification. Numerical results will be presented.

3 - Enhance System Performance for Energy Market
Deanne Zhang, Paragon Decision Technology, 5400 Carillon Point, Kirkland, WA, 98033, United States of America, Deanne.Zhang@aimms.com

For a Two-settlement Energy Market, ISO (Independent System Operator) is facing a series of mathematical problems with thousands of variables and constraints. How to get reliable solutions in short period of time is critical. Thus we are going to look at some helpful implementation techniques in AIMMS, including linearization of quadratic models, multiple-solver session schemes and sub-gradient calculation.

4 - A New Convex Quadratic Programming Relaxation for Binary Quadratic Programming Problems
Rui Yang, Graduate Student, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, ruiyang1@illinois.edu, Jiming Peng, Peng Jiang

We consider a special class of (0,1) binary quadratic programming problems (BQP) where the number of nonzero elements is fixed. We use the convex quadratic relaxation as a geometric embedding tool to reformulate the underlying BQP as a clustering problem where the target is to find a single cluster of fixed size. Incorperating with SDP relaxation technique, we propose a 2-approximation algorithm to solve this clustering problem. Numerical results are included as well.

■ TA61

H-Room 312, Third Floor

Facility Location

Contributed Session

Chair: Boonlert Wongcharoensangsiri, PhD Student, Department of Industrial Engineering, Texas Tech University, 2500 Broadway, Lubbock, TX, 79409, United States of America, boonlert.wongcharoensangsiri@ttu.edu

1 - The Optimal Location of Elevator for the Multi-floor Manufacturing Environment
Chikong Huang, Professor, Institute of Industrial Engineering and Management, National Yunlin University of Science & Technology, 123 University Road, Section 3, Department of Industrial Management, Touliu, Yunlin, 64002, Taiwan - ROC, huangck@yuntech.edu.tw, Ming-Ru Tsai, Jeng-Shin Chen

The location of elevator is an important layout issue especially for the multi-floor, automatic manufacturing plants. This research develops a mathematical model and associated solution procedure to find the optimal location for elevator. It is also assumed: (1) All transporting items are moved along a fixed and closed-

loop moving track on each floor. (2) The location of elevator can be arranged at any point on the closed-loop moving track. A numerical example is also demonstrated.

2 - Locating Service Centers under Service Level Constraints in Continuous Space

Prahalad Venkateshan, AmTrust Bank, 1801 East 9th Street, Cleveland, United States of America, prahalad@gmail.com, Kamlesh Mathur

In this paper, we develop a column generation-based algorithm addressing the problem of finding the optimal location of a given number of service centers in a continuous space servicing geographically distributed customer regions. Service is offered by mobile servers which travel to the customer regions and return back to the service center. The service level constraint is based on the probability of wait. The objective function comprises the transportation and staffing costs.

3 - Lower and Upper Bounds for a Capacitated Transshipment Point Location Problem with Handling Costs

Jinfeng Li, PhD Student, University of Technology of Troyes, 12 Rue Marie Curie, BP 2060, Troyes, 10000, France, jfli_1983@hotmail.com, Christian Prins, Feng Chu

We introduce a transshipment point location problem considering handling costs occurred at transshipment points. Decisions are made to locate capacitated transshipment points between capacitated plants and customers to transport various types of products. We propose a hybrid method including a Lagrangean relaxation, a column generation and a heuristic to provide lower and upper bounds of the problem. Computational results show that gaps between the upper and lower bound are within 2.5%.

4 - Robust Location of Staging Area in Wind Farm Logistics

Boonlert Wongcharoensangsiri, PhD Student, Department of Industrial Engineering, Texas Tech University, 2500 Broadway, Lubbock, TX, 79409, United States of America, boonlert.wongcharoensangsiri@ttu.edu, John Kobza

We present a staging area location assignment model for a wind farm logistics problem when the wind farm location is unknown. A minimax approach is applied to determine the robust solution for all possible wind farm locations. Two types of objective functions are studied. One is the total cost of staging area, inventory, and transportation. Another is the regret which is the added cost over the cost if the specific location of the wind farm were known when the site of the staging area is chosen.

■ TA62

H-Room 313, Third Floor

Behavioral Studies on Individual Factors and Performance

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Julie Niederhoff, Assistant Professor, Whitman School of Mangement, Syracuse University, 721 University Avenue, Syracuse, NY, 13244, United States of America, jniederh@syr.edu

1 - How to Set Goals? An Experimental Inquiry

José Larco, PhD. Candidate, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, 3000 DR, Netherlands, jlarco@rsm.nl, Kees Jan Roodbergen, Rene De Koster, Jan Dul

Setting goals for enhancing performance has been widely studied in the field of Industrial Psychology. However, questions remain for operations management: Which goal to set to optimize performance? How to recognize if a goal is adequately set? What is the effect of goals in the variability of performance (within and between subjects)? We conduct an experiment for answering these questions and validating a theoretical model that can be used to inform several other workflow operational models.

2 - Bargaining and Channel Coordination

Valery Pavlov, Penn State University, vpavlov@psu.edu, Elena Katok, Ernan Haruvy

We investigate the effect of the bargaining process on channel coordination. Earlier studies reported that coordinating contracts fail to coordinate or even increase efficiency beyond the levels of a simple wholesale price contract. The reason for this failure is that offers that result in an unequal relative profit split tend to be rejected. These past studies used a take-it-or-leave-it bargaining format. We investigate more flexible bargaining rules and find that they improve efficiency.

3 - Personal Factors and Contract Perfomance

Julie Niederhoff, Assistant Professor, Whitman School of Mangement, Syracuse University, 721 University Avenue, Syracuse, NY, 13244, United States of America, jniederh@syr.edu, Panos Kouvelis

Existing behavioral work in supply chain coordination contracts looks at the overall performance of contracts and finds them insufficient in average system improvement. We investigate the cause of these suboptimal decisions to determine how risk aversion and fairness concerns drive decision making in individual decision makers.

■ TA63

H-Room 314, Third Floor

Patient Scheduling

Contributed Session

Chair: Robert Storer, Professor, Lehigh University, 200 West Packer Av., Bethlehem, PA, 18015, United States of America, rhs2@lehigh.edu

1 - Constructing Nurse - To - Patient Assignments In A Neonatal Intensive Care Unit

Ilgin Acar, Doctoral Associate, Western Michigan University, Parkview Campus, Department of Industrial and Manufacturi, Kalamazoo, MI, 49008-5336, United States of America, ilgin.acar@wmich.edu, Steven E. Butt, Tycho Fredericks

This study considered a nurse-to-patient assignment problem in a neonatal intensive care unit at a southwest Michigan hospital. The resulting model includes constraints that take into account elements of a nurse's workload during a shift. Background regarding the unit under study will be briefly discussed and model assignments will be presented.

2 - A Sample Average Approximation Algorithm for Appointment Scheduling

Robert Storer, Professor, Lehigh University, 200 West Packer Av., Bethlehem, PA, 18015, United States of America, rhs2@lehigh.edu, Camilo Mancilla

We present algorithms for the appointment sequencing and scheduling problem with waiting, idle time and over time costs. The full stochastic problem is approximated using a scenario based sample average approach. The algorithms for the resulting stochastic integer programming problem are based on Bender's decomposition where the master problems are solved approximately by a fast heuristic.

■ TA64

H-Room 202A, Second Floor

Teaching OR/MS

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Eric Huggins, Associate Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

1 - What are Students NOT Learning in Introductory Statistics?

Susan Palocsay, Professor of Computer Information Systems and Management Science, James Madison University, CIS & MS Department, MSC 0202, Harrisonburg, VA, 22807, United States of America, palocssw@jmu.edu, Scott Stevens

Statistics is an essential prerequisite for OR/MS, and the challenges of effectively teaching introductory statistics are well known. Formal assessment of student learning in our introductory business statistics course over the past six years has provided us with documentation of specific problem areas. We report on overall student performance and present empirical data identifying the most common errors and misconceptions. We also suggest teaching approaches to address some of these errors.

2 - The Thoughtful and Effective Classroom

Xu Yang, University of Louisville, Department of Industrial Engineering, Louisville, United States of America, x0yang07@louisville.edu

The issue of how to develop an OR/MS class in a diverse student group is discussed. We introduce The New American Lecture Strategy as well as how to incorporate this strategy in a typical OR/MS classroom. By targeting students as different groups, different teaching styles and techniques can be used, such as an anticipatory set or hook, an advanced visual organizer, deep processing and periodic thinking. We believe that the novel strategy can make the class more thoughtful and effective.

3 - Teaching Lean Principles Using Hands-On Simulation: Experiences and Outcomes Across Universities

Sharon Johnson, Associate Professor, Worcester Polytechnic Institute, 100 Institute Rd, Worcester, MA, 01609, United States of America, sharon@wpi.edu

While lean thinking principles appear straightforward, practitioners need to critically examine processes, value drivers, and constraints to effectively apply them. We describe a pedagogical approach to teaching lean based on a hands-on simulation created by TimeWise Management Systems, used by 20 business and engineering programs. We contrast the implementation experience across programs, including material use, how learning was assessed, the support needed, and faculty observations.

4 - Teaching OM at a Liberal Arts College: Why Do I Have to Take This Class?

Eric Huggins, Associate Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

Operations management can be a challenging course for students majoring in operations, engineering or mathematics; for business students at a small, liberal arts institution, OM may be the most difficult course that a student will take in his or her college career. For example, consider linear programming: How does one teach and motivate students to learn such a hard topic? I will discuss successful teaching techniques that I have developed over the past seven years (and a few failures, too).

■ TA65

H-Room 202B, Second Floor

Panel Discussion: Challenges and Opportunities for Women in Academia

Sponsor: Women in OR/MS
Sponsored Session

Chair: Sadan Kulturel-Konak, Associate Professor, Penn State Berks, Management Information Systems, Reading, PA, 19610, United States of America, sadan@psu.edu

1 - Challenges and Opportunities for Women in Academia

Moderator: Sadan Kulturel-Konak, Associate Professor, Penn State Berks, Management Information Systems, Reading, PA, 19610, United States of America, sadan@psu.edu, Panelists: Lama Moussawi, Alice E. Smith, Elisabeth Pate-Cornell, Pinar Keskinocak

This panel will focus on different challenges and opportunities for women academics in Industrial Engineering and Operations Research areas. Panelists will discuss their unique perspectives of the issues affecting the success of women in academic and administrative positions in the US and in the Middle East countries.

■ TA66

H-Room 204A, Second Floor

Operations with Financial Concerns

Sponsor: MSOM/ iFORM
Sponsored Session

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

Co-Chair: Gongtao (Lucy) Chen, Assistant Professor, National University of Singapore, 1 Business Link, NUS Business School, Singapore, 117592, Singapore, bizcg@nus.edu.sg

1 - Supply Chain Optimization with Financial Constraints and Cost of Financial Distress

John Birge, Professor, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, john.birge@chicagogsb.edu, Song (Alex) Yang

While supply chain contracts have been widely studied in the operations management literature, little attention has been been paid to how actual financial flows between firms influence the performance of a supply chain. In this talk, we formulate the firms' financing decisions and the cost of financial distress explicitly. We show that trade credit can improve supply chain performance, re-allocating the power between the supplier and the retailer.

2 - Financing the Newsvendor: Supplier vs. Bank, Optimal Rates, and Alternative Schemes

Wenhui Zhao, Washington University in St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63117, United States of America, ZHAO@olin.wustl.edu, Panos Kouvelis

Within a Stackelberg modeling framework, we explore the impact of trade credit contracts in a capital constrained supply chain, when break-even bank loans are available. We show that the supplier should always finance the retailer, and the retailer always prefers supplier to bank financing. While the supply chain and supplier's profits improve, the retailer might also improve his profits relative to bank financing, depending on his wealth. We also provide insights when bankruptcy costs exist.

3 - The Impact of Financial Turbulence on Inventory Control

Gongtao (Lucy) Chen, Assistant Professor, National University of Singapore, 1 Business Link, NUS Business School, Singapore, 117592, Singapore, bizcg@nus.edu.sg, Robin Roundy, Rachel Zhang, Lawrence W. Robinson

We incorporate financial uncertainties into a single-product, periodic-review, finite-horizon stochastic inventory system by modeling both the discount factors and operational costs as stochastic processes that evolve as financial uncertainties are realized. We establish conditions under which (s, S) policies are optimal. We also show that both the business type and the stockout protocol have large impacts on inventory decisions and on the cost penalty for ignoring the financial volatility.

■ TA67

H-Room 204B, Second Floor

Stochastic Nonparametric Approaches to DEA

Cluster: Data Envelopment Analysis
Invited Session

Chair: Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi

1 - Data Envelopment Analysis as Nonparametric Least Squares Regression

Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi, Andy Johnson

We show that DEA can be interpreted as nonparametric least squares regression subject to shape constraints on frontier and sign constraints on residuals. Parametric programming (Aigner&Chu 1968) is thus a special case of DEA. Using these insights, we develop a nonparametric variant of COLS. We show that the new C2NLS method is consistent and asymptotically unbiased. The links established in this paper contribute to integration of the econometric and axiomatic approaches to efficiency analysis.

2 - Nonparametric Efficiency Estimation in the Presence of Contextual Variables

Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu, Timo Kuosmanen

Banker and Natarajan (2008) analyze 2-stage DEA models and quantify the detrimental effects of correlation between the inputs and the context through Monte Carlo simulation. We introduce two contextual variables models called 1-stage DEA and C2NLS in the presence of contextual variables (C2NLSCV) which allow for correlation between the contextual variables and the input levels. Monte Carlo simulation results are presented to demonstrate the superior performance of these estimators.

3 - Efficiency Analysis of Finnish Crop Farms by Stochastic Nonparametric Envelopment of Data (StoNED)

Nataliya Kuosmanen, MTT Agrifood Research Finland, Luutnantintie 13, Helsinki, 00410, Finland, nataliya.kuosmanen@mtt.fi, Timo Kuosmanen

Stochastic Nonparametric Envelopment of Data (StoNED) approach by Kuosmanen (2006) and Kuosmanen and Kortelainen (2007) combines the axiomatic, nonparametric DEA-style frontier with stochastic SFA-style inefficiency and noise terms. In this paper we apply the StoNED method to estimate farm-level efficiency scores in a sample of 141 Finnish crop farms specialized in wheat.

4 - Productivity Differentials in Dairy Farming - A Comparison of Methods

Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi, Subal Kumbhakar, Timo Sipilainen

The aim is to analyse the regional productivity differentials on dairy farms. We apply both econometric and mathematical programming methods including stochastic nonparametric estimation. The data of 954 farms is obtained from the EU's FADN data set for Denmark, Finland and Sweden in 2003. The results suggest that different methods provide slightly different results but in all approaches productivity differentials are considerable in favour of Danish farms.

■ TA68

H-Room 206, Second Floor

Sampling in Stochastic Optimization: Methodology and Application

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu

1 – Introducing CO2 Allowances: Higher Prices for All Consumers, Higher Revenues for Who?

Romeo Langestraat, Tilburg University, Dept. of Econometrics and OR, Tilburg, 5037 AB, Netherlands, r.langestraat@uvt.nl, Gul Gurkan, Ozge Ozdemir, Yves Smeers

Related to efforts of reducing CO2 emissions, we analyze the effects of introducing a cap-and-trade system or taxation on capacity investments under perfect competition using a two-stage Nash game. We illustrate how to solve these models as stochastic programs or complementarity problems under uncertainty, using sampling. We show that if there is shortage of transmission capacity in the system, only introducing a cap-and-trade system or taxation is neither sufficient to curb CO2 levels nor necessarily induces investments in cleaner technologies, respectively.

2 - Overlapping Batches for Variance Reduction in Optimality Gap Estimation in Stochastic Programming

David Love, Program in Applied Mathematics, University of Arizona, 617 N. Santa Rita Ave., Tucson, AZ, 85721-0089, United States of America, dlove@math.arizona.edu, Guzin Bayraksan

We investigate the use of overlapping batches for assessing solution quality in stochastic programs. Motivated by the original use of overlapping batch means in simulation, we present a variant of the multiple replications procedure that uses overlapping batches to decrease the variance of the optimality gap estimator, while leaving the bias unaffected. Theoretical and empirical results are given.

3 - Assessment of Solution Quality for Some Nonlinear Stochastic Problems Using Bootstrap

Fabian Bastin, Assistant Professor, Université de Montréal, Dpt of Computing Science and Oper. Res., CP 6128, Succ Centre-Ville, Montreal, H3C 3J7, Canada, bastin@iro.umontreal.ca

We consider minimization of problems based on Monte-Carlo draws obtained using physical data, which can be costly to obtain. Since independent samples are then difficult to construct, bootstrap appears appealing to evaluate estimations accuracy. We apply this approach on some specific problem classes and compare it to other popular techniques, which can be deficient when some assumptions are relaxed. We also briefly explore the use bootstrap in stopping criteria for more general problems.

4 - A Probability Metrics Approach for Bias and Variance Reduction in Optimality Gap Estimation

Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu, Rebecca Stockbridge

Monte Carlo sampling-based statistical estimators of optimality gaps for stochastic programs are known to be biased. We present a method for bias reduction in these estimators via a probability metrics approach, which can be done in polynomial time in sample size. We show that the resulting estimators after bias reduction produce consistent point estimators and asymptotically valid confidence intervals. Our preliminary computational results show that this procedure can also reduce variance.

■ TA69

H-Indigo A, Second Floor

PR Research Workshop

Cluster: Grassroots PR for Operations Researchers
Invited Session

Chair: Barry List, INFORMS, Hanover, MD, 21076, Barry.List@informs.org

1 - Grassroots PR: How You Can Leverage your Accomplishments and Make Headlines in Your Local News

Barry List, INFORMS, Hanover, MD, 21076, Barry.List@informs.org

Are you doing research that affects consumers, business people, government, and those who follow the news? Is your consulting work pleasing your clients but not registering with a broader world? Should local, national and online news take notice? In this workshop, INFORMS communications director Barry List will provide you with ways of leveraging your accomplishments with your university's or company's PR department, as well as the local press, to bring attention to best work. Attend only if you can bear the bright lights and attention of the new - and traditional - media.

■ TA75

C-Room 32A, Upper Level

Joint Session RAS/TSL: Recent Advances in Transportation Planning Systems

Sponsor: Railroad Applications & Transportation Science and Logistics
Sponsored Session

Chair: Ravindra Ahuja, President, Innovative Scheduling, GTEC, 2153 SE Hawthorne Road, Suite 206, Gainesville, FL, 32641, United States of America, ravi@innovativescheduling.com

1 - New Algorithmic Approaches for Solving the Curfew Planning Problem

Ashish Nemani, University of Florida, Department of Industrial and Systems, Engineering, Gainesville, FL, 32611, United States of America, aknemani@ufl.edu, Suat Bog, Ravindra Ahuja

We study the Curfew Planning Problem(CPP) encountered by railroads for the maintenance of tracks. The CPP is to design an annual schedule to complete a set of jobs (rail/tie-work) on the railway tracks for a set of crews specialized in rail or tie work. We develop the work schedule for each crew such that the disruptions in train routes are minimized. The solution must also satisfy several operational and regulatory requirements. Our paper presents several exact models and heuristics the CPP.

2 - A Simulation-based Decision Support System for Railroad Terminal Capacity Planning

Edward Lin, OR Analyst, Norfolk Southern Corporation, 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, edward.lin@nscorp.com, Clark Cheng

This paper presents a rail yard simulation framework that can be used to identify terminal capacity improvement opportunities. The framework provides the flexibility and adaptability to conduct and manage what-if analysis on train service plan, traffic mix, yard layout, operating policy, operational strategy, and resources. Therefore, the development time for a new yard can be reduced significantly. We describe the implementation of the framework in a major hump yard at Norfolk Southern.

3 - Multi-year Installation Design of Railroad Wayside Defect Detection Installations

Fan Peng, University of Illinois at Urbana-Champaign, 205 N. Matthews Avenue, B156, Urbana, IL, United States of America, fanpeng2@illinois.edu, Xiaopeng Li, Yanfeng Ouyang

Railroads use wayside inspection technologies to monitor health of railcars. Due to resource constraints, an efficient and feasible installation plan should be integrated into a multi-year deployment framework to derive the maximum benefit. We propose a large-scale network optimization model to solve this problem, and develop efficient solution techniques based on Lagrangian Relaxation. Numerical case studies illustrate the application of this model on real-world cases.

Tuesday, 11:00am - 12:30pm

■ TB01

C-Room 21, Upper Level

Portfolio Decision Analysis II

Sponsor: Decision Analysis
Sponsored Session

Chair: Alec Morton, Lecturer in Operational Research, London School of Economics, Houghton St, London, WC2A2AE, United Kingdom, A.Morton@lse.ac.uk

1 - The Impact of Stochastic Price Models on Portfolio Selection

J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu, Brandon Pope, James E. Smith

Significant advances have been made in our ability to model market prices that evolve stochastically through time. However, questions regarding the usefulness of these models remain. For example, in a portfolio setting, do price process models change project rankings or simply move all projects together? In this talk, we describe settings where price process models are important and those where they are not. This has important implications for the use of these models in practice.

2 - Tracking Project Flow in an R&D Portfolio: A Case Study
Jay Andersen, Sr Research Fellow, Eli Lilly & Co, Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, andersen_john_s@lilly.com

Traditional R&D Scorecards measure the progress of research programs in development by counting the number of programs that pass key milestones, and comparing this tally to annual targets. For the past 18 months, Lilly R&D has been tracking portfolio progress with a new Flow Scorecard. This new method for tracking progress has several advantages over the traditional method, providing governance committees access to a more sensitive and comprehensive tool for measuring portfolio progress.

3 - R&D Portfolio Investment Analysis with Approximate Dynamic Programming
Joseph Hartman, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, jchartman@ufl.edu, Pinar Keles, Jack Kloeber

We model the R&D portfolio investment process with stochastic dynamic programming. As the state space to represent a portfolio of projects is of high dimension, we employ approximation techniques to extend the horizon of analysis and ensure good time zero decisions while also providing a procedure to validate our solutions.

4 - Optimizer's Curse in Project Portfolio Selection
Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, 02015, Finland, ahtisalo@cc.hut.fi, Juuso Liesiö, Bert De Reyck

Portfolios are often built by selecting the projects with the best expected performance. Because the prior performance estimates are uncertain, this selection process gives rise to the optimizer's curse phenomenon so that the prior estimates of selected projects tend to be higher than their actual performance. We analyze how this phenomenon depends on the performance estimates and the share of projects that are selected. We also consider implications for the design of selection processes.

■ TB02

C-Room 22, Upper Level

Information and Learning in Operations Management

Sponsor: Decision Analysis
Sponsored Session

Chair: Canan Ulu, University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Canan.Ulu@mccombs.utexas.edu

1 - Information Gathering Through Different Channels in Newsvendor Problems
Canan Ulu, University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Canan.Ulu@mccombs.utexas.edu, James E. Smith

We study information gathering policies in a multi-period newsvendor problem if the demand distribution is unknown. Previous models study information gathering through observed demand or sales; we assume that in addition to choosing an order quantity, the newsvendor has the option to gather additional information about demand prior to placing his order. We discuss structural properties of the optimal profits and order quantities.

2 - Learning in Spatial Product Differentiation Models
Dorothee Honhon, University of Texas at Austin, 1, University Station, Austin, TX, 78712, United States of America, Dorothee.Honhon@mccombs.utexas.edu, Aydin Alptekinoglu, Canan Ulu

A firm decides the assortment of products to offer in a given category, over a 2-period horizon. Customer preferences are represented by a one-dimensional spatial differentiation model but the firm does not know the exact distribution of customer preferences. Given a prior distribution, the firm decides how many products to offer and where to locate them. After observing the (possibly censored) sales in period 1, the firm updates the prior and determines the assortment in period 2.

3 - Simulation Calibration with Correlated Knowledge-Gradients
Peter Frazier, Assistant Professor, Cornell University, Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu, Warren Powell, Hugo Simao

We consider calibration of an approximate dynamic programming model used by the logistics company Schneider National. Each run of the model requires approximately 12 hours of CPU time and produces noisy non-stationary output, making calibration difficult. We show how the knowledge gradient algorithm may be used to adaptively search through the space of parameter settings to quickly and effectively find a parameter vector that is among the best at causing model output to match historical data.

4 - Acquisition of Project-specific Assets with Bayesian Updating
Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu, Steven Lippman

We study the effect of learning on the optimal policy and the time-to-decision in a sequential decision model with two irreversible alternatives, exit and expansion. In our model, the firm undertakes a small-scale pilot project with a noisy return so as to learn, via Bayesian updating, about the project's profitability before making the expansion or exit decision. As the speed of learning increases, the continuation region expands, but the time-to-decision does not monotonically increase.

■ TB03

C-Room 23A, Upper Level

Multi-Criteria Decision Making

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Mark Karwan, Professor, University at Buffalo, 305 Bell Hall, Buffalo, NY, 14216, United States of America, mkarwan@eng.buffalo.edu

1 - A Heuristic Approach for Multiobjective Combinatorial Optimization
Murat Koksalan, Middle East Technical University, IE Department, ODTU, Ankara, 06531, Turkey, koksalan@ie.metu.edu.tr

We develop a heuristic approach to approximately represent the nondominated points of multiobjective combinatorial optimization problems. The approach is based on fitting a surface that passes through a small number of available nondominated solutions. We demonstrate its performance on a number of problems and discuss possible uses.

2 - An Objective Decomposition-coordination Method for Interactive Decision-Making
Alexander Engau, Assistant Professor, University of Colorado Denver, Mathematical and Statistical Sciences, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, aengau@alumni.clemson.edu, Margaret Wiecek

To facilitate trade offs and preference articulation in multi-criteria decision-making, a decomposition scheme is proposed that restructures the original problem into smaller subproblems with only subsets of the original criteria. A priori preferences on trade offs are integrated into this process by modifying the Pareto order by general domination cones, and decision makers are supported by an interactive procedure to coordinate any remaining trade offs using concepts of approximate efficiency.

3 - Linear/linear Multiobjective Bilevel Programs
Herminia I. Calvete, Associate Professor, University of Zaragoza, Statistical Methods Department, Pedro Cerbuna 12, Zaragoza, 50009, Spain, herminia@unizar.es, Carmen Gale

Bilevel programs are characterized by the existence of two optimization problems, in which the constraint region of the upper level problem is implicitly determined by the lower level optimization problem. This talk focuses on bilevel programs with multiple objectives at the lower level. In the linear case, we prove some geometrical properties of the feasible region and the global optimal solution. Some ideas are given on algorithms to solve the problem.

4 - An Interactive Approach for Multicriteria Implicit Alternatives Using a Tchebycheff Utility Function
Ozgen Ozbey, PhD Candidate, University at Buffalo, 418 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 14260-1900, United States of America, oozbey2@buffalo.edu, Mark Karwan

We propose an interactive multicriteria method for implicit alternatives to help a Decision Maker (DM) obtain a most preferred solution. We present an MILP formulation to generate multipliers which are consistent with a DM's response to pairwise comparisons. We approximate the DM's utility function by a Tchebycheff function or a hybrid function combining Tchebycheff and linear components. Computational results and comparisons with various utility functions and other methods are presented.

■ TB04

C-Room 23B, Upper Level

Integration of Data Mining and Statistical Process Control

Sponsor: Data Mining
Sponsored Session

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

1 - Dectection of a Change in Poisson Count Data under Non-homogeneous Population

Sung Won Han, PhD Candidate, Georgia Institute of Technolgoy, Altanta, GA, United States of America, shan@isye.gatech.edu, Kwok Tsui, Yajun Mei

The topic is about the on-line monitoring problem of detecting a mean change of Poisson distributions under non-homegenous population. The most common detection scheme is the generalized likelihood ratio statistics, which is known as an optimal method under Lodern's criteria. However, alternative detection schemes we proposed perform better than generalized likelihood ratio statistics. The properties of the detection schemes are investigated both theoretically and by numerical simulation.

2 - A Nonparametric T2 Control Chart for Multivariate Process Monitoring

Poovich Phaladiganon, Ph.D. Student, University of Texas at Arlington, Arlington, TX, United States of America, poovich@gmail.com

In this study, we extend the ideas of using the bootstrap method in univariate control charts to multivariate control chart, called the bootstrap percentile approach. This approach is determined as an alternative to construct the control limit based on T2 statistics. A simulation study was conducted to measure the performances of the proposed approach, kernel density estimation (KDE), and T2 control chart. The proposed method performed better than T2 chart while it is comparable to KDE.

3 - A Linkage Ranking Algorithm for Multivariate Quality Control

Panitarn Chongfuangprinya, Ph.D. Candidate, University of Texas at Arlington, United States of America, panitarn.chongfuangprinya@mavs.uta.edu, Seoung Bum Kim, Helen Bush, Victoria Chen

When the assumption of normally distributed quality characteristics is invalid, traditional multivariate quality control methods may not be as desirable as nonparametric methods. The nonparametric method in this paper constructs charts based on the ranking of the new measurement relative to the training data, and new algorithm for calculating ranks are presented. Simulations are performed to demonstrate the effectiveness of our method and their superiority over Hotelling's T2.

4 - One-Class Classification-based Control Charts for Monitoring Multivariate and Autocorrelated Process

Weerawat Jitpitaklert, Ph.D. Candidate, University of Texas at Arlington, Arlington, United States of America, weerawat.net@gmail.com, Seoung Bum Kim, Thuntee Sukchotrat

Statistical process control for multivariate and autocorrelated process has received a great deal of attention. We propose a one-class classification method to deal with multivariate and autocorrelated process. By using simulated data, analysis and comparison of the one-class classification-based control charts and the traditional Hotelling's chart are presented.

■ TB05

C-Room 23C, Upper Level

Panel Discussion: Quality Improvement in Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

1 - Quality Improvement in Nanomanufacturing

Moderator: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu, Panelists: C F Jeff Wu, Chuck Zhang

Nanomanufacturing poses tremendous challenges and opportunities for quality and productivity improvement. The panelists will discuss the research issues and opportunities in nanomanufacturing and share their experience.

■ TB06

C-Room 24A, Upper Level

Recent Advances in Computer Experiments II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Peter Qian, Assistant Professor, University of Wisconsin-Madison, 1300 University Ave, Department of Statistics, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Construction of Orthogonal and Nearly Orthogonal Latin Hypercubes

Devon Lin, Construction of Orthogonal and Nearly Orthogonal Latin Hypercubes, Queen's University, Jeffery Hall, University Ave., Kingston, ON, Canada, devon.lin@queensu.ca, Rahul Mukerjee, Derek Bingham, Randy Sitter, Boxin Tang

An important yet challenging research problem in the area of computer experiment is to develop a general methodology for the construction of good designs with high dimensionality. Recently, a useful approach that has been gaining momentum focuses on the construction of orthogonal and nearly orthogonal Latin hypercubes. We will introduce two powerful methods that build large designs using small ones. We will also examine how to make use of both methods to obtain a useful collection of orthogonal or nearly orthogonal Latin hypercubes.

2 - A Kriging Approach to the Analysis of Climate Model Experiments

Dorin Drignei, Oakland University, Mathematics and Statistics, Rochester, MI, 48309, United States of America, drignei@oakland.edu

A climate model is a computer implementation of a mathematical model for the physical, chemical and biological processes underlying the climate. These models are computationally intensive, allowing only small computational experiments. We present a multidimensional kriging method to predict climate model variables at new inputs, such as new greenhouse gas and aerosol concentrations, based on the experimental data available.

3 - A Simple Approach to Integrated Emulation for Computer Experiments

Qiang Zhou, University of Wisconsin Madison, ISyE Dept, 1513 University Avenue, Madison, WI, 53706, United States of America qzhou3@wisc.edu, Shiyu Zhou, Peter Qian

We consider prediction of computer experiments with multiple responses which are correlated. Specially designed correlation structure has been proposed to improve predictions by combining several responses together. The proposed method can be realized through simple modifications of univariate Kriging method, and is able to provide better prediction.

■ TB07

C-Room 24B, Upper Level

Quality and Reliability in Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

Co-Chair: Abe Zeid, Northeastern University, College of Engineering, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zeid@coe.neu.edu

1 - Bayesian Process Control of Buckypaper Manufacturing for Improved Quality and Repeatability

Arda Vanli, Florida State University and Florida A&M University, 2525 Pottsdamer Street, Tallahassee, United States of America, oavanli@eng.fsu.edu

Despite developments in processing technology, repeatability and part-to-part variability in carbon nano-tube composites remains important. A challenge in nano-manufacturing is that due to the high cost of raw materials, sufficient experimentation required to build accurate statistical models may often be very expensive. We propose a Bayesian predictive approach that allows incorporating prior process knowledge and optimization of buckypaper manufacturing processes from small experimental sets.

2 - Developing a Process Model to Monitor the Growth of Molecular Beam Epitaxy Nanomanufacturing Process

Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

This paper addresses the quality and repeatability of MgO thin films grown on a 6H-SiC substrate. Molecular Beam Epitaxy process is employed to grow these films with controlled structural, and stoichiometric and functional properties. Using the historical data, we conducted Design of Experiments (DOE) to analyze the interactions among process variables and their influence on the quality parameters.

3 - Self-Assembled Templates for Device Fabrication on Si Wafer and Roll-to-Roll® Process Platforms

James Watkins, University of Massachusetts, oom A616 Conte Research Center, Amherst, United States of America, watkins@polysci.umass.edu

The fabrication of nanotechnology enabled devices requires not only the creation and functionalization of well defined nanostructures, but also practical routes for the two and three dimensional integration of these structures with components and systems across multiple length scales. Approaches for the use of self-assembled block copolymer templates to achieve these goals for sub-10 nm elements using either Si wafer or roll to roll processing platforms will be discussed.

■ TB08

C-Room 24C, Upper Level

Special Problems in Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48859, United States of America, shaha1s@cmich.edu

1 - Use and Abuse of Regression

Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48859, United States of America, shaha1s@cmich.edu

Regression is used for relating a dependent variable with many independent variables. The relationship is then judged by R-squared. Also, data is collected overtime which may have serial correlation. However, many published articles show regression with less than .5 R-squared and some do not even include the Durbin-Watson test. Such articles are not based on sound statistical analysis. My paper will discuss the use of appropriate statistical methods for sound, acceptable research.

2 - Prioritizing Which Data to Collect Next When Predicting System Reliability

Christine Anderson-Cook, Los Alamos National Laboratory, P.O. Box 1663 MS F600, Los Alamos, NM, 87544, United States of America, candcook@lanl.gov

When analyzing reliability of a complex system, several types of data from full-system tests to component level tests may be available. After a preliminary analysis, additional resources may be available and we wish to identify the best new data to collect to maximally improve the prediction of system reliability. Methodology is presented about selecting appropriate criteria to rank different allocations, and determining what new data to collect to improve our understanding of the response.

3 - Intrinsic Complexity of Classification Problems

Tin Kam Ho, Group Leader, Statistics and Learning Research, Bell Labs, Alcatel-Lucent, 600 Mountain Ave., 2C-381, Murray Hill, NJ, 07974, United States of America, tkh@research.bell-labs.com

Successful application of classification methods depends on a good match between the method and the task. This requires understanding of both the classifier's behavior and the characteristics of the problem. We describe some measures that characterize intrinsic data complexity and its relationship to classifier performance, and discuss results on identifying the domains of dominant competence of several popular classifiers in this measurement space.

■ TB09

C-Room 25A, Upper Level

Numerical Methods for Stochastic Controls

Sponsor: Applied Probability
Sponsored Session

Chair: Jim Dai, Edenfield Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332, United States of America, dai@gatech.edu

1 - Contracting on the Process of Discovery

Xingwen Zhang, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, xingwenz@stanford.edu, Sunil Kumar

We model the alliances between pharmaceutical companies and biotech companies for drug discovery as continuous-time principal-agent problems. We consider an additional source of risk beyond usual imperfect effort monitoring, namely, the success or failure of the discovery process whose hazard rate depends on the effort. We characterize the optimal contracts via the solution to an HJB equation, illustrate these contracts via numerical computation and simulation, and empirically test our findings.

2 - Drift Control with Changeover Costs

Melda Ormeci Matoglu, Ozyegin University, Kusbakisi Cad No 2, Altunizade, Istanbul, Turkey, Melda.Ormeci@ozyegin.edu.tr, John Vande Vate

We model managing capacity in a BTO environment as a Brownian drift control problem. With a practical restriction we model it via a structured LP and show an optimal solution to the restricted problem can be found among a special set of policies. We exploit new relationships between complementary dual solutions and relative value functions to obtain a lower bound on the avg. cost of any nonanticipating policy. We show that our LP approach is asymptotically optimal for the unrestricted problem.

3 - A Computational Method for Stochastic Impulse Control Problems

Kumar Muthuraman, Professor, McCombs School of Business, kumar@austin.utexas.edu, Haolin Feng

We consider the instantaneous control of a diffusion process on the real line. The cost of control has both fixed and proportional components. The objective is to minimize the expected infinite horizon discounted costs. Standard dynamic programming arguments result in a Quasi-Variational-Inequality (QVI). We present a method to efficiently solve the QVI and show that it monotonically converges to the optimal solution. We also present error bounds and application examples.

■ TB10

C-Room 25B, Upper Level

Queueing

Sponsor: Applied Probability
Sponsored Session

Chair: Alan Scheller-Wolf, Associate Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu

1 - Real-time Pricing Under Uncertainty for Loss Systems

Robert Hampshire, hamp@andrew.cmu.edu, Cathy Xia

We consider real time services where the demand function is unknown. Arriving customers pay the announced price upon admission and expect to receive service at a specific quality level. When the system capacity is full, arrivals are lost. Our goal is to develop a profit maximizing joint pricing and capacity planning decision method for real time services in the face of uncertain stochastic demand. Applications include e-services and street parking price management.

2 - Dynamic Control of Parallel Flexible Servers Under the Risk of Disruption: The 'W' Network Network

Soroush Saghafian, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, soroush@umich.edu, Mark Van Oyen, Bora Kolfal

We address the problem of assigning flexible servers to different job types in a general parallel queueing framework where servers are heterogeneous and subject to stochastic disruptions. We investigate the structure of the optimal policy and develop a strong heuristic that outperforms the well-known available policies.

3 - An Analytical Approximation for a Closed Fork/Join Network with Multi-Station Input Subnetworks

Erkut Sonmez, Assistant Professor, Boston College, Carroll School of Management, Fulton, Hall, 140 Commonwealth Ave, Chestnut Hill, MA, 02467, United States of America, esonmez@andrew.cmu.edu, Alan Scheller-Wolf, Nicola Secomandi

Fork/join stations are used for modeling synchronization between entities, and fork/join queueing networks are natural models for a variety of communication and manufacturing systems. In this paper, we present a simple approximation method to estimate the throughput of a closed queueing network that features a single fork/join station receiving inputs from multi-station subnetworks.

4 - Design and Analysis of Diagnostic Service Centers

Xiaofang Wang, Renmin University of China, School of Business, Beijing, China, xiaofang.wang@gmail.com, Alan Scheller-Wolf, Stephen F. Smith, Laurens Debo

Nurse lines are call centers that provide advice to patients about what the most appropriate course of action is according to their symptoms. We build a model to help nurse line managers decide on the optimal service depth and the staffing level to effectively perform a diagnostic process between agents and customers. We analyze properties of the optimal decision and obtain insights into an enhanced understanding of the fundamental trade-offs in nurse-line management practice.

■ TB11

C-Room 25C, Upper Level

Queueing Applications in Manufacturing and Maintenance

Cluster: Queueing Models
Invited Session

Chair: Isilay Talay Degirmenci, Duke University Fuqua Business School, 1 Towerview Drive, Durham, NC, 27708, United States of America, it@duke.edu

1 - A State-dependent Markov Chain Model for Cycle Time Estimation of Complex Manufacturing Systems

Raha Akhavan-Tabatabaei, North Carolina State University, E. P. Fitts Department of Ind and Sys Eng, Raleigh, NC, 27695, United States of America, raha.akhavan.tabatabaei@gmail.com, Shengwei Ding, J. George Shanthikumar

Classical queueing models often overestimate the cycle time of complex manufacturing systems. One root cause for this inaccuracy is their underlying assumption of independence between the arrival and service processes.We develop a state-dependent Markov chain model for a single stage multi-server queue with heterogeneous servers. The arrival and service rates of this system are dependent on the WIP and the number of working tools. We show that this model predicts the cycle time more accurately.

2 - Evaluation of Assembly/Disassembly Queueing Networks with Blocking and General Service Times

Michael Manitz, University of Cologne, Supply Chain Management & Production, Köln, 50923, Germany, manitz@wiso.uni-koeln.de

We study multi-stage tree-structured assembly/disassembly queueing systems with finite buffers, generally distributed service times, and synchronization constraints at assembly and disassembly stations. To approximate the throughput of such a queueing network and to estimate the variance of the inter-departure times at the stations, a decomposition approach is used. It requires a system of decomposition equations. The quality of the presented approach is tested against simulation results.

3 - Scheduling Policies in the Repair Shop for the Spare Parts Provisioning Problem

Robert Svaluto, University of Toronto, 5 King's College Rd., Toronto, ON, M5S 3G8, Canada, svaluto@mie.utoronto.ca, Baris Balcioglu

The system being considered consists of two different types of repairable components, as well as an inventory for each type. The repair shop is modelled as a single server queue, where First Come First Serve, non-preemptive priority, and myopic policies are investigated as possible repair shop scheduling policies. The performance of these policies will be compared with the optimal policy with the objective of minimizing the system cost, which includes holding and backordering costs.

4 - Performance-based Dimensioning of the Machine-repairmen Problem

Isilay Talay Degirmenci, Duke University Fuqua Business School, 1 Towerview Drive, Durham, NC, 27708, United States of America, it@duke.edu, Otis Jennings

Employing a many-server (or Halfin-Whitt) approach to system design, we revisit the classic machine-repairmen-spares problem, which models a fleet of homogeneous breakdown-prone vehicles, a repair facility and replacement vehicles. Using large scale asymptotics, we approximate time-to-begin-repair and time-to-replacement performance metrics as functions of repair capacity and spare vehicle decision variables. The two-dimensional nature of our work distinguishes it from other many-server studies.

■ TB12

C-Room 26A, Upper Level

Network Flows

Sponsor: Computing Society
Sponsored Session

Chair: Eli Olinick, Associate Professor, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, olinick@engr.smu.edu

1 - Extreme-Point Search Heuristics for Interval-Flow Transshipment Networks

Richard Barr, Department Chair, Associate Professor, EMIS Department, Bobby B. Lyle School Engineering, Southern Methodist University, Dalllas, TX, 75275-0123, United States of America, barr@lyle.smu.edu, Robert Jones

Interval-flow network models allow minimum-flow requirements a solution's active arcs. While this characteristic is prevalent in practice, the resulting problems are NP-hard. Our adjacent extreme-point search heuristics quickly identifies high-quality solutions to large-scale problem instances. A computer implementation of this approach is tested on problems with up to 10,000 nodes and 100,000 arcs, giving solution speeds over 400 times faster than Cplex 10.

2 - Formulation of Mergers Among Oligopolistic Firms with Insights into the Merger Paradox

Anna Nagurney, John F. Smith Memorial Professor, UMass, Finance and Operations Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu

In this paper, we formulate network models of oligopolistic firms pre and post horizontal mergers as variational inequality problems. The flexibility of the computational approach, which yields closed form expressions at each iteration, allows us to gain deeper insights into the merger paradox.

3 - A New LP Formulation for the Maximum Concurrent Flow Problem

Eli Olinick, Associate Professor, EMIS Department, Bobby B. Lyle School Engineering, Southern Methodist University, Dallas, TX, 75275-0123, United States of America, olinick@lyle.smu.edu, David Matula, Jason T. Kratz

The MCFP is a multicommodity flow problem in a congested network where the objective is to maximize the ratio of the flow supplied between a pair of vertices to the predefined demand for that pair. For practical applications, MCFP gives rise to difficult-to-solve LPs and so the problem has received considerable attentionin the literature. We present a new formulation that yields significantly smaller LPs for the MCPF than the traditional arc-path or node-arc formulations.

■ TB13

C-Room 26B, Upper Level

Panel Discussion: COIN-OR Technology Forum

Sponsor: Computing Society
Sponsored Session

Chair: Matthew Saltzman, Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States of America, mjs@clemson.edu

1 - COIN-OR Technology Forum

Moderator: Matthew Saltzman, Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States of America, mjs@clemson.edu, Panelists: Lou Hafer, Robin Lougee-Heimer, Bjarni Kristjansson, Kipp Martin, Ted Ralphs

Attend the COIN-OR Technology Forum to meet COIN-OR project managers and board members, hear about recent developments in COIN-OR projects and future plans, contribute your ideas, or volunteer your time and skills to help make COIN-OR a better source of open-source software tools for operations research.

■ TB14

C-Room 27A, Upper Level

Optimization in Practice IV - Software

Sponsor: Computing Society
Sponsored Session

Chair: Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Optimization in Strategic Business Planning
Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Applying optimization techniques to strategic business planning can provide benefits that are potentially far greater than those realized by optimizing routine business operations. Quite simply, doing the right thing is far more important than doing the wrong thing well. We discuss the lessons learned in Vanguard's development of a forecasting and stochastic optimization solution that Novartis Vaccines & Diagnostics uses to optimize its drug investment activities.

2 - Efficient Optimization with Portfolio Safeguard Software
Stan Uryasev, University of Florida, Department of Industrial and Systems Engineer, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, uryasev@ufl.edu

We will present several case studies mostly in financial optimization area conducted using Portfolio Safeguard optimization software. Case studies will cover the following topics: portfolio optimization and portfolio hedging with downside risk measures such as VaR, CVaR, Drawdown, and others.

3 - Valid Inequalities for an Integer Programming Model for Software Projects with Soft Deadlines
Ishwar Murthy, Professor, Indian Institute of Management, Bannerghatta Road, Bangalore, 560076, India, ishwar@IIMB.ERNET.IN, Kaushik Dutta, Sridhar Narasimhan

We develop an integer programming model that enables software development companies manage software engineers (in-house and vendors) at their disposal to complete their projects with minimal violation of the project deadlines. The manpower requirement as well as the skill sets required for each project in each time period is known. The above NP-Hard problem is modeled as a multi-commodity path problem on an acyclic graph, with side constraints.

4 - OptForce™ Strategic Workforce Planning Technology: Combining Simulation and Optimization
Jay April, Chief Development Officer, OptTek Systems, Inc., 1919 Seventh Street, Boulder, CO, 80302, United States of America, april@opttek.com, James Kelly, Marco Better, Fred Glover

This presentation describes simulation optimization software technology being developed under a National Science Foundation SBIR contract to be used to enhance strategic workforce planning and management. The software combines two innovative methods drawn from the field of operations research: agent-based simulation and metaheuristic optimization. The software, which is called OptForceô, is used to evaluate decisions for creating, modifying, and eliminating workforce policies and programs.

■ TB15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Imagine That - ExtendSim-Power Tools for Simulation
Dave Krahl, Imagine That, Inc., 6830 Via Del Oro, Suite 230, San Jose, CA, 95119, davek@extendsim.com

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

2 - AIMMS (Paragon) - Monte Carlo Simulation Versus Stochastic Optimization
Peter Nieuwesteeg, Senior AIMMS Specialist, AIMMS (Paragon Decision Technology), 5400 Carillon Point, Kirkland, WA, 98033, United States of America, p.nieuwesteeg@aimms.com, Deanne Zhang

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

■ TB16

C-Room 28A, Upper Level

Personalization and Privacy

Sponsor: Information Systems
Sponsored Session

Chair: Shivendu Shivendu, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, Room # SB 426, Irvine, CA, 92697, United States of America, sshivend@exchange.uci.edu

1 - Resolving Personalization-Privacy Dilemma: A Privacy-Preserving Contract for Online Personalization
Jia Jia, Doctoral Student, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, China, jiajia1015@gmail.com, Raymond G. Sin

We design a privacy-preserving contract for online personalized services, and find that even in the absence of external instruments, the online vendor can derive an incentive-compatible contract that serves the entire market. Within this framework, we further investigate how the optimal contract would change if the government enforced a 'minimum-privacy-protection' policy, and identify the optimal level of such a threshold that maximizes the social welfare from the policy maker's perspective.

2 - Enabling Websites to Respect Privacy Norms and Preferences in Web Personalization
Alfred Kobsa, Professor, University of California, Irvine, Department of Informatics, Irvine, CA, United States of America, kobsa@uci.edu, Yang Wang

Internationally operating personalized website are often obliged to cater to different national privacy laws. They also need to take users' individual privacy preferences and industry self-regulation into account. We present a dynamic privacy-enhancing personalization framework that selects personalization methods during runtime in such a way that prevailing privacy constraints are being respected. We show that our approach is scalable to even the largest current websites.

3 - Economics of Software as a Service under Security Concerns
Shivendu Shivendu, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, Room # SB 426, Irvine, CA, 92697, United States of America, sshivend@exchange.uci.edu

Software as a Service (SaaS) is an overarching term for software delivery as a shared online service, and often includes on-demand applications and infrastructure. While users are increasingly getting attracted to this radically different way of software delivery and consumption, concerns regarding data security persist. In this paper we examine a firm's pricing strategies for on-line delivery of software as a service in a market with users that have heterogeneous concerns for data security.

■ TB17

C-Room 28B, Upper Level

Applications of Two-sided Markets

Sponsor: e-Business
Sponsored Session

Chair: Olivier Rubel, UC Davis, One Shields Avenue, Davis, CA, United States of America, orubel@ucdavis.edu

1 - Benchmarking Media-platforms: A Method and Application to Daily Newspapers
Shrihari Sridhar, Assistant Professor of Marketing, Michigan State University, 370 N. Business Complex, East Lansing, MI, 48824, United States of America, sswcb@mizzou.edu, Esther Thorson, Murali Mantrala, Prasad Naik

Our focus is benchmarking in the media industry.Media-firms' two-sided business model presents three challenges. We combine Network DEA and Multivariate Sliced Inverse Regression in a fashion that tackles these challenges.Our proposed approach is general and can be used in benchmarking other (non-media) two-sided platforms.Using data on U.S. print newspaper firms, we demonstrate how the proposed approach outperforms applications of the existing approaches applied to platforms.

2 - Hybrid Advertising Auctions
Yi Zhu, University of Southern California, 3660 Trousdale Parkway, ACC 306E, Department of Marketing, USC, Los Angeles, CA, 90089, United States of America, zhuy@usc.edu, Kenneth Wilbur

Several major websites offer hybrid auctions that allow advertisers to bid on a per-impression or a per-click basis for the same advertising space. The conventional wisdom is that brand advertisers (e.g. Coca-Cola) will bid per impression, while direct response advertisers (e.g. Amazon.com) will bid per click. We analyze a theoretical model of advertiser bidding to ask whether this conventional wisdom will hold up in equilibrium.

3 - Optimal Fundraising for a Charity
Olivier Rubel, UC Davis, One Shields Avenue, Davis, CA, United States of America, orubel@ucdavis.edu

I propose a dynamic model to investigate what should be for a charity, the optimal budget allocation between fundraising and program services. The state variable is the level of donation at time t, which growth is stimulated by the fundraising effort of the organization and the observed effort in program services. I investigate the dynamic consequences of such situation and explore various elements with respect to the management of charities.

■ TB18

C-Room 28C, Upper Level

Resiliency in Telecommunication Systems

Sponsor: Telecommunications
Sponsored Session

Chair: Jose Ramirez-Marquez, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, United States of America, Jose.Ramirez-Marquez@stevens.edu

1 - Connectivity Management in Mobile Ad-Hoc Networks
Abdullah Konak, Associate Professor, Penn State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, auk3@psu.edu, Alice E. Smith, Orhan Dengiz

This paper proposes a dynamic mobile ad-hoc network (MANET) system to improve network connectivity by using controlled network nodes, called agents. Agents have predefined wireless communication capabilities similar to the other nodes in the MANET. However, their movements and thus their locations are dynamically determined to optimize network connectivity. A particle swarm optimization algorithm is used to choose optimal locations of the agents.

2 - Two-Terminal Reliability under the Asymptotic Random Waypoint Spatial Distribution
Binchao Chen, Texas Tech University, 3102 4th St, Apt. 101, Lubbock, TX, 79415, United States of America, binchao.chen@gmail.com, aaron phillips, Timothy Matis

Estimating the two-terminal reliability of a mobile ad-hoc network (MAWN) is a critical measure in many applications, particularly those that are defense related. The spatial distribution of a MAWN under a random waypoint model is shown to have central tendency asymptotically. In this presentation, we demonstrate the method by which two-terminal reliability may be estimated in this case and provide numerical examples.

3 - Resiliency Techniques for Telecom Applications
Jose Ramirez-Marquez, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, United States of America, Jose.Ramirez-Marquez@stevens.edu

In many illegal activities networks are set up by the perpetrators to conduct their operations, such as smuggling goods, contraband, and people across borders or ports. To potentially interdict these networks in a successful and cost effective way, multi,Äêobjective evolutionary algorithms are being developed to overcome issues of current techniques. This presentation will discuss how network interdiction can be used to describe metrics such as vulnerability, resiliency and restoration response.

4 - Reliability for Defense Systems of Systems and Network Centric Systems
Jason Cook, US Army ARDEC, Bldg 62N, Picatinny, NJ, 07869, United States of America, jason.cook1@us.army.mil

Adoption of IT in the defense industry means systems formally singular are now connected via networks. In the network centric paradigm, reliability is paramount. Here multi-state reliability is combined with the ad-hoc network reliability methods to measure the reliable performance of a SoS and its elements by considering network connectivity, the interactions of connected elements and the resultant capability.

■ TB19

C-Room 28D, Upper Level

Traffic Assignment Methods

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Laurie Garrow, Georgia Tech, 790 Atlantic Dr, Atlanta, 30332, United States of America, Laurie.Garrow@ce.gatech.edu

1 - A Dynamic Traffic Assignment Model for a Highly Congested Urban Network
Moshe Ben-Akiva, Massachusetts Institute of Technology, Cambridge, MA, United States of America, mba@mit.edu, Song Gao, Yang Wen, Zheng Wei

We present the calibration of DynaMIT-P for modeling the highly congested and complex traffic network in Beijing, China. All demand and supply inputs and parameters were calibrated simultaneously using sensor counts and floating car travel time data. Successful calibration was achieved with the Path-Size Logit route choice model, explicit representations of lane groups, and a modified treatment of acceptance capacities to account for the large number of short links in the network.

2 - Large Network Application of Bi-criterion Dynamic Traffic Assignment Model with Heterogeneous Users
Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Lan Jiang, Chung-Chen Lu

We discuss strategies for application of bi-criterion dynamic equilibrium models to large-scale regional networks to evaluate toll pricing proposals and other network improvements. Improvements in algorithm design and implementation are discussed and demonstrated using the Baltimore region network.

3 - Disequilibrium Importance Measure of Network Components and Braess Paradox
Henry Liu, Assistant Professor, Department of Civil Engineering, University of Minnesota, 500 Pillsbury Drive S.E., Minneapolis, MN, 55455, United States of America, henryliu@umn.edu, Xiaolei Guo

We propose an importance measure of network components from a disequilibrium perspective and show that an unimportant link from the traditional equilibrium viewpoint could be important from a disequilibrium perspective. We then provide simple and ordinary grid networks with regular BPR link cost functions such that Braess paradox occurs, which indicate that Braess paradox can occur in real transportation networks.

4 - On the Existence of System Optimal Pricing Strategies in the Heterogeneous Single Bottleneck Model
Satish Ukkusuri, satish.ukkusuri@gmail.com, Kien Doan, Gitakrishnan Ramadurai

The heterogeneous single bottleneck with pricing is formulated as a linear program with complementary constraints. The non-existence of optimal pricing schemes are is shown in both the homogenous and heterogeneous problems. Computational results to demonstrate the pricing schemes are shown. In addition, practical pricing schemes which can possible be implemented will be discussed.

■ TB20

C-Room 28E, Upper Level

Joint Session AAS/TSL: Air Traffic Flow Management Models

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Michael Ball, Robert H Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, mball@rhsmith.umd.edu

1 - Stochastic and Dynamic Algorithm for Planning Ground Delay Programs Under Uncertainty in Airport Capacity
Avijit Mukerjee, U.C. Santa Cruz, MS 210-8, NASA Ames, Moffett Field, CA, 94035, United States of America, itsavijit@gmail.com, Shon Grabbe, Mark Hansen

This paper presents an algorithm for dynamically assigning flight departure delays under probabilistic airport capacity. Trade-off analysis is performed between various efficiency and equity metrics. As a case study, the algorithm is applied to assign departure delays to flights scheduled to arrive at San Francisco International Airport under uncertainty in the clearance time of fog. Experiments indicate that the proposed algorithm delays could reduce delays up to 20% compared to current level.

2 - From Uncertainty in Individual Flight Events Predictions to Probabilistic Traffic Demand Predictions

Eugene Gilbo, U.S. Department of Transportation, 1200 New Jersey Ave. SE, Washington, DC, 20590, United States of America eugene.gilbo@dot.gov, Scott Smith

An important element of NextGen program is probabilistic traffic flow management. The paper presents a method for the probabilistic representation of aggregate traffic demand predictions through consideration of the uncertainty in predictions of estimated time of arrival (ETA) for individual flights. It uses historical data from the existing Traffic Flow Management System to illustrate the differences between probabilistic and deterministic predictions.

3 - Geometric Recourse Model for Optimal Route Generation

Yoonjin Yoon, UC Berkeley, 107D McLaughlin Hall, Berkeley, CA, 94720, United States of America, yoonjin@berkeley.edu, Mark Hansen, Michael Ball

We study a probabilistic air traffic management strategy to reduce weather related delay. Geometric model is set up that with a recourse option to the destination if the weather clears en route. Analytic study identifies the condition of successful hedging and provides an analytic solution. Numerical study compares no-hedging, single and double recourse geometric models, leading to a conclusion that more responsive traffic control has larger impact in reducing delay.

4 - Preference Based Proportional Random Allocation of Enroute Resources

Nasim Vakili, University of Maryland, 3117 AVW Bldg, College Park, MD, 20742, United States of America, nasimv@umd.edu, Michael Ball

We describe new methods for the fair allocation of access to constrained enroute airspace. We propose a randomized procedure that will consider flight operators preferences over their flights. The new methods allow some flights to be refused access, since flight operators have the option of rerouting around the constrained airspace. Our procedure has potential usefulness both in airspace flow program planning and in the emerging System Enhancements for Versatile Electronic Negotiation.

■ TB21

C-Room 30B, Upper Level

Methods and Models for Road Pricing III

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu

Co-Chair: Siriphong Lawphonganich, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611-6595, United States of America, lawphong@ise.ufl.edu

1 - Solving Path-based System-optimal Dynamic Traffic Assignment via Path Marginal Cost

Zhen (Sean) Qian, University of California Davis, Institute of Transportation Studies, University of California Davis, Davis, CA, 95616, United States of America, zqian@ucdavis.edu, Michael Zhang, Wei Shen

The path marginal cost (PMC) is defined as the equivalent monetary cost of the total amount of congestion in the network caused by one additional vehicle. The knowledge of PMC is central to system-optimal dynamic traffic assignment. This research proposes an innovative approach to compute PMC approximately but efficiently for general networks. The correctness and efficiency is demonstrated by solving the marginal cost dynamic tolls for a synthetic network and SO-DTA in a real corridor network.

2 - Realization Probability of Traffic User Equilibrium and Its Implications to Congestion Pricing

Xuegang (Jeff) Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St, JEC 4034, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu

In case the user equilibrium solution is not unique, we define the realization probability of a traffic equilibrium solution as the probability of realizing the solution given the distribution of the initial traffic system state. We illustrate how the realization probability can be calculated by assuming the day to day route choice adjustment process. Studying such a probability may have important implications to network design and congestion pricing applications.

3 - Differentiated Vehicle Mileage Fees: Incorporating Welfare, Revenue and Environmental Considerations

Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu, B. Starr McMullen

Fixed vehicle mileage fees encourage the ownership and use of fuel inefficient vehicles. This paper employs several methodologies to assess environmentally-friendly variable distance-based user charges. Results show that the welfare and revenue impact is sensitive to policy design. Models ignoring behavioral responses overestimate revenue changes by 11~28%. The most important behavioral responses are short-run adjustments unrelated to vehicle ownership decisions.

4 - Optimal Deployment of High-Occupancy Vehicle/Toll Lanes in General Networks

Ziqi Song, University of Florida, Department of Civil and Coastal Engineering, Gainesville, FL, 32608, United States of America, ziqi@ufl.edu, Siriphong Lawphonganich, Yafeng Yin

This paper investigates how to deploy high-occupy vehicle/toll (HOV/HOT) lanes in general networks. A mathematical program with complementarity constraints is formulated and solved to simultaneously determine the locations of HOV or HOT lanes and the toll rates on HOT lanes to maximize the social benefit. Numerical examples using networks in the literature are presented to verify the model.

■ TB22

C-Room 30C, Upper Level

Risk Management in Supply Chains I

Contributed Session

Chair: Jun-Yeon Lee, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, leej@uhv.edu

1 - A Multi-product Risk-averse Newsvendor under Coherent Risk Measures

Sungyong Choi, PhD Candidate, Rutgers Business School, 180 University Avenue, PhD Program in Management, Newark, NJ, 07102, United States of America, sungyongchoi@gmail.com, Andrzej Ruszczynski, Yao Zhao

We consider a multi-product risk-averse newsvendor under coherent risk measures. We first establish the convexity in the model. Then we derive the impact of risk aversion, asymptotic behavior and closed-form approximations of the optimal order quantities with independent demands. The approximations are as simple as to compute as the classical newsvendor model. For dependent demands case, we study the impact of demand correlation. These analytical results are confirmed by our numerical study.

2 - Dynamic Inventory and Financial Hedging Decisions for Storable Commodities

Zhan Pang, Research Associate, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, zhan.pang@utoronto.ca, Panos Kouvelis, Qing Ding

We address the problem of dynamic joint inventory and financial hedging decisions of a storable commodity for a risk-averse firm. In mean-variance framework, we show that the state-dependent base-stock policy is optimal for inventory control. We also show how to construct an optimal dynamic hedging strategy and explore the impact of financial hedges on dynamic inventory policy.

3 - Information Security in Supply Chain Networks

Harpreet Singh, UCONN, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, harpreet.singh@business.uconn.edu, Manuel Nunez, Jose Cruz

Firms often face situations in which there is a need to disclose confidential or strategic information to suppliers, thus increasing their risk of disclosing sensitive information to suppliers and also to competitors connected to suppliers in the supply chain network. In this paper, we create a mathematical model which relates disclosure risk to supply chain network topology, and thus help retailers to assess risk and return of doing business with a supplier embedded in a supply chain network.

4 - Group Decision Support System to Assess Inbound Supply Risk

Rajesh Hadavale, Grosscurth Fellow, University of Louisville, S 2nd Street, Louisville, KY, 40208, United States of America, rajesh.hadavale@gmail.com, Suraj Alexander

It is critical to assess Inbound Supply Risk to ensure uninterrupted supply of the necessary components and services. In this context we propose a group decision support system that provides a framework to identify, classify, and access inbound supply risk. The proposed model considers risk as time dependent and periodically gets Intensity preferences from group of decision maker that are aggregated to estimate the level of risk.

5 - Supply Chain Collaboration with Vendor-managed Inventory under Exchange Rate Uncertainty

Jun-Yeon Lee, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, leej@uhv.edu

VMI (Vendor-Managed Inventory) is a well-known industry practice for supply chain collaboration. In this paper we study supply chain collaboration with VMI in a global environment, in which the manufacturer and the supplier face

exchange rate uncertainty. In particular, we examine what is the optimal VMI contract for the manufacturer and what is the optimal inventory policy for the supplier under the VMI contract and exchange rate uncertainty.

■ TB23

C-Room 30D, Upper Level

Applications of Optimization to Operations at the US Air Force Academy

Sponsor: Military Applications Society
Sponsored Session

Chair: Andrew Armacost, Professor and Department Head, US Air Force Academy, Dept of Management, 2354 Fairchild Drive, Suite 6H122, USAF Academy, CO, 80840, United States of America, andrew.armacost@usafa.edu

1 - USAF Academy OR Capstone Course & Project Outgrowth
Maureen Borgia, Asst Professor, USAF Academy, Department of Management, 2354 Fairchild Dr, Ste 6H-130, USAF Academy, CO, 80132, United States of America, maureen.borgia@usafa.edu, James Lowe, Andrew Armacost

The US Air Force Academy OR major concludes with a 2-semester capstone course sequence during which senior cadets solve a real-world problem. Problems are solicited from organizations including the USAF Academy, US Air Force, Department of Defense, local government, and local non-profit groups. A number of projects have solved various scheduling and matching issues for the USAF Academy. The outgrowth of these projects continue to be used by the USAF Academy and are maintained by faculty.

2 - Summer Seminar Scheduling at AFA
James Lowe, Professor of Operations Research, US Air Force Academy, Department of Management, 2354 Fairchild Drive, Suite 6H-130, USAF Academy, CO, 80840, United States of America, jim.lowe@usafa.edu

The Air Force Academy Summer Seminar allows high school students to observe, learn, and enjoy the Colorado summer. Over 3300 Students select from 25 different academic programs offered. Historically, students were placed into academic programs on a first-come, first-serve basis. We created a more efficient method of assigning students. In 2009, all 3300 students received at least one of their top 3 choices. We discuss the XPRESS optimization Excel spreadsheets developed to assist staff.

3 - Optimization of the Cadet Military Performance Appraisal Process at USAFA
Mark Parker, Associate Professor, Carroll College, Department of Math, Engineering, and CS, 1601 N. Benton Avenue, Helena, MT, 59625, United States of America, mparker.math@gmail.com, James Lowe

In order to provide more diverse input to cadet military performance, USAFA revamped their Military Performance Appraisal (MPA) system during the 2008-9 academic year. The goal was to have 3 faculty members, up to 10 subordinates, and up to 5 peers rate each cadet. We discuss the XPRESS optimization developed for the faculty/cadet assignment and the Excel spreadsheets developed for the peer-to-peer and subordinate-to-supervisor assignments.

4 - Scheduling AF Academy Summer Operations Tours
Andrew Armacost, Professor and Department Head, US Air Force Academy, Dept of Management, 2354 Fairchild Drive, Suite 6H122, USAF Academy, CO, 80840, United States of America, andrew.armacost@usafa.edu, Mark Parker, Nick Hainsfurther, James Lowe

Each AF Academy student is required to spend between one and three summers at an active Air Force base. We develop an optimization model to match more than 3,000 students to these operations tours, considering capacity constraints at each base, requirements for each cadet to visit bases with different missions, and to have each cadet visit bases in various geographic areas. We discuss the model's implementation using Xpress-MP and the impact this model has had on the Air Force Academy.

■ TB24

C-Room 30E, Upper Level

OM Models of Strategic Customers, Customer Learning

Cluster: Economic Models in Operations Management
Invited Session

Chair: Brian Tomlin, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States of America, brian.tomlin@tuck.dartmouth.edu

Co-Chair: Ali K. ParlakturkAssistant Professor, UNC Kenan-Flagler Business School, McColl Bldg S4708, Campus Box 3490, Chapel Hill, NC, 27599, United States of America, Ali_Parlakturk@unc.edu

1 - Estimation, Pricing, and Strategic Customer Behavior
Adam Mersereau, Asst. Professor, University of North Carolina, Kenan-Flagler Business School, CB #3490, Chapel Hill, NC, 27599-3490, United States of America, ajm@unc.edu, Dan Zhang

A growing segment of the revenue management and pricing literature assumes "strategic" customers who are forward-looking in their pursuit of utility. Recognizing that such behavior may not be directly observable, we examine the implications in a markdown pricing setting of seller uncertainty around the proportion of customers behaving strategically. We prove revenue bounds for single-season problems, and we examine multi-season versions where the seller estimates demand based on observations.

2 - Risk Pooling with Strategic Customers
Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, swinney_robert@gsb.stanford.edu

We investigate the value of various risk pooling strategies when a firm sells to strategic, or forward-looking, customers. Such customers anticipate future changes in price and product availability, and may take this information into account when making their own purchasing decisions. We consider the impact of this behavior on the value of risk pooling both for a single firm and for a supply chain.

3 - Signaling Service Quality in Queues
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu

We study how a high quality service firm signals quality to differentiate from a low quality service firm under congestion prone environments. Rational consumers join queues based on signaling efforts of the firms, congestion in the market, and the service value. We show that it is likely high quality firms may incur lower revenues due to signaling efforts.

4 - The Value of Product Variety When Dealing with Strategic Customers
Ali K. Parlakturk, Assistant Professor, UNC Kenan-Flagler Business School, McColl Bldg S4708, Campus Box 3490, Chapel Hill, NC, 27599, United States of America, Ali_Parlakturk@unc.edu

We consider a firm that sells two vertically (quality) differentiated products to strategic consumers over two periods setting the prices dynamically in each period. The consumers are heterogeneous in their evaluations of quality and they are strategic in that they decide not only whether and which product variant to buy, but also when to buy choosing the option that maximizes their utility. We derive the equilibrium of the pricing-purchasing game between the firm and the consumers.

■ TB25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Cost of Airline Delays, Cancellations, and Capacity Constraints

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Mark Hansen, UC Berkeley, 114 McLaughlin Hall, University of California, Berkeley, CA, 94720, United States of America, mhansen@ce.berkeley.edu

1 - Costs to Businesses of Air Travel Delays
Kevin Neels, Principal, The Brattle Group, 44 Brattle Street, Cambridge, MA, 02138, United States of America, Kevin.Neels@brattle.com

This presentation will examine the costs that air travel delays impose on businesses. It will consider how increased travel time and decreased reliability affects costs and performance. Finally, the presentation will explore some of the strategies businesses have adopted to cope with the uncertanties of air travel, including both changes in traveler behavior, and substitition of non-travel alternatives.

2 - Estimating the Impact of Airport Capacity Constraints on the Number and Timing of Scheduled Flights
Prem Swaroop, University of Maryland, College Park, MD, pswaroop@rhsmith.umd.edu, Mark Hansen, Michael Ball

Airport capacity constraints impact airline scheduling behavior in a variety of ways. These include 1) scheduling fewer flights, 2) scheduling flights at less desirable times and 3) moving service to "secondary" airports. We present a combination of statistical and optimization methods that quantify the extent of these effects. Our results allow the estimation of the economic impact of capacity constraints as they pertain to schedule changes.

3 - Evaluating the Economic Impact of NAS Performance on Airline Operations-an Econometric Approach

Bo Zou, Mr., National Center of Excellence for Aviation Operations Research, 109 McLaughlin Hall, UC Berkeley, Berkeley, CA, 94720, United States of America, bzou@berkeley.edu, Mark Hansen

This paper examines the impact of NAS performance on airline operations by estimating cost functions that include NAS performance as new arguments. The development of performance measures is based on factor analysis of metrics developed and a priori consideration. Results reveal delays, cancellation and scheduling padding present significant impacts. Using the estimated cost models, we predict airline costs associated with current NAS performance reach a magnitude of 10 billion dollars.

■ TB26

C-Room 31B, Upper Level

Stochastic Optimization I

Contributed Session

Chair: Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu

1 - Definition of Maintenance Policies Applying Stochastic Optimization

Carlos Osorio-Ramirez, Politecnico Grancolombiano, Calle 57 3 00 Este Fac. Ingenieria, Bogota, Colombia, caosorio@poligran.edu.co, Javier Nieto, Jesus Velasquez

This paper presents a non-anticipative stochastic optimization model in order to determine the most common maintenance decisions, according to a set of possible scenarios with some feasible sequences of failures.

2 - Computational Experience of Solving Two-stage Stochastic Linear Programming Problems

Viktar Zviarovich, PhD Student, CARISMA, Brunel University, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom, viktar.zviarovich@brunel.ac.uk, Csaba Fabian, Francis Ellison, Gautam Mitra

We present a computational study of two-stage SP solution algorithms for a range of benchmark problems. We consider application of (1) Simplex method and (2) IPM to solve deterministic equivalent problems, (3) Benders decomposition, (4) stochastic decomposition and (5) three regularisation methods. The first method is an experimental heuristic regularisation. The last two are based on the level decomposition by Fabian and Szoke. The scale-up properties and the performance profiles are presented.

3 - A Stochastic Inventory Model for Critical Spare Parts Used for Maintenance of Construction Machines

Nihat Kasap, Assistant Professor, Sabanci University, Faculty of Management, Istanbul, 34956, Turkey, nihatk@sabanciUniversityedu, Ilker Bicer

We develop a stochastic inventory model for critical spare parts used for the maintenance of heavy construction machines. Proposed model is a nonlinear integer optimization problem with average service level and replenishment frequency constraints. The aim of the model is to find out reorder points and stocking levels of critical spare parts that minimize the inventory costs. We propose heuristic that contains modified ABC Analysis and can be implemented with the spreadsheet applications easily.

4 - Progressive Hedging Applied to Stochastic Forestry Planning Problem

Fernando Badilla Veliz, Master in OR thesist, Universidad de Chile, Beauchef 850, Santiago, Manuel de Salas 35, depto. 151, – Uñoa, Santiago, Chile, fbadilla@ing.uchile.cl, David Woodruff, Andres Weintraub, Roger Wets

The problem consist in planning the optimal harvest, deciding when and which lots to harvest, roads to build (binary decisions) and the wood flow through these roads; under different†probabilistic price, demand and yield scenarios. We present an approach to solve this integer stochastic problem†which handles the non anticipativity constraints based on the heuristic progressive hedging, decomposing the problem so that it's not limited by the number of scenarios considered.

5 - A Recursive Decomposition Algorithm for Generating p-Efficient Points

Rahul Nair, Grad Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu, Elise Miller-Hooks

p-efficient points are employed in solving programs with joint chance constraints where the random vector is discrete. Generating these points is problematic when the number of dimensions or domain of the random vector is large. A new recursive decomposition algorithm is proposed that restricts the search to sub-domains that contain the p-frontier thereby reducing the computation and memory requirements.

■ TB27

C-Room 31C, Upper Level

Uncertainty Modeling and Simulation

Sponsor: INFORMS Simulation

Sponsored Session

Chair: Elmira Popova, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States of America, elmira@mail.utexas.edu

1 - Preventive Maintenance Optimization Using Non-parametric Methods

Dmitriy Belyi, The University of Texas at Austin, United States of America, all_hail_dima@hotmail.com

This paper focuses on the problem of finding the minimal-cost preventive maintenance schedule for a single item. We model the problem using the failure rate of the item, and develop an efficient optimization algorithm under typical conditions on the failure rate. If the failure rate is unknown, we employ a Gibbs sampling algorithm to simulate from the failure rate using real data. We then analyze the effectiveness of this approach on some generated and real data sets.

2 - Sustainability Toolkit for Simulation-Based Logistics Decisions

Michael Kuhl, Associate Professor, Rochester Institute of Technology, Industrial & Systems Engineering Department, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, mekeie@rit.edu, Xi Zhou

As sustainability issues are becoming an integrated part of operational and long-term decisions, simulation tools are needed to aid in the decision-making process. We introduce the concept of a simulation-based sustainability toolkit and present a prototype of one portion of the toolkit for simulating sustainability aspects of logistics systems. The toolkit enables decision-makers to have sustainability measures as readily available as traditional productivity performance measures.

3 - Random Environment Models for Software Reliability

Refik Soyer, George Washington University, 2201 G Street NW, Funger Hall 415, School of Business, Washington, DC, 20052, United States of America, soyer@gwu.edu

We consider reliability assessment of a software system which is subject to a dynamic operating environment. In so doing, we discuss hidden Markov models as well as other modulating processes for describing dynamics of the environment. We develop Bayesian inference for these models.

4 - Simulating Cointegrated Time Series

Elmira Popova, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712, United States of America, elmira@mail.utexas.edu, Ivilina Popova, Alexander Galenko

We present new theoretical results for cointegrated time series. They allow us to create a special input for the Vector AustoRegresive To Anything (VARTA) algorithm such that the cointegration property is preserved. We illustrate the procedure with four financial time series.

■ TB28

H-Room 500, Fifth Floor

Revenue Management in Online Advertising

Sponsor: Revenue Management and Pricing

Sponsored Session

Chair: Tammy Wang, St. Market Research Manager, Microsoft Corp., One Microsoft Way, Redmond, WA, United States of America, yiwa@microsoft.com

1 - Revenue Management in Online Advertising: Challenges and Opportunities

Aaron Easterly, General Manager, Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052, United States of America, aeast@microsoft.com

The scale of transactions and data in online advertising exercises and challenges revenue management theories. The complexity and dynamic nature of the data pushes the limits of research. Improvements in revenue management methods can be deployed rapidly and result in many millions of dollars in incremental revenue. This session will discuss current, real-world challenges in the search and display advertising domains, and provide insight into how this space is evolving to meet new demands.

2 - An Empirical Model of Search Advertising Auctions
Susan Athey, Professor, Harvard University, athey@fas.harvard.edu

We introduce a model of bidding behavior in sponsored search advertising markets incorporating the fact that in practice, bids are fixed for a period of time, during which many features of the environment change, including the set of opposing bidders and the system's quality scores used for ranking bids. We use historical data from a search engine to generate estimates of bidder valuations. We compute counterfactual equilibria to evaluate the auction design.

3 - Exploring the Long Tail in Paid Search Advertising
Randolph Bucklin, Peter W. Mullin Professor, University of California, Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90266, United States of America, randy.bucklin@anderson.ucla.edu

We explore the phenomenon of the "long tail" in an advertiser's list of keywords in paid search campaigns. While a small proportion of keywords will account for most user activity (i.e., searches, clickthroughs, purchase transactions) those in the tail may be quite attractive. We empirically examine the question how keywords in the long tail perform for advertisers relative to the more popular ones.

4 - Yield Optimization in Display Ad Networks
Peng Han, Sr. Research Manager, Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052, United States of America, penha@microsoft.com

A display ad network is a middleman between online publishers, the supply side, and online advertisers, the demand side. It buys inventory (impressions) from the publishers, resells them to the advertisers, and profits from the price differences. This paper talks about the application of optimization in Microsoft Media Network (MMN), and the modeling/solving techniques to meet the performance requirement.

■ TB29

H-Room 501, Fifth Floor

Energy Model and Methods

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

Chair: Steven Gabriel, Dr., University of Maryland, 1143 Martin Hall, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, sgabriel@umd.edu

1 - Pricing of Binary Variables in Energy Market Equilibrium Models
David Fuller, UWaterloo, 200 University Ave, Waterloo, Canada, dfuller@engmail.uwaterloo.ca

In market equilibrium models with only continuous variables, prices are usually extracted as dual variables of constraints. However, many models require some binary variables – on/off decisions in short term models, or build/don't build decisions in long term capacity planning models. There is no established way to define prices of discrete activities, so equilibrium is difficult to define. I present a two-part pricing approach to resolve some difficulties. Applications will be suggested.

2 - Coordinating Biofuels Policies: Can We Meet Multiple Standards?
Elena Safirova, Dr., Resources for the Future, 1616 P Street, NW, Washington, DC, Safirova@rff.org, Steven Gabriel, Shalini Vajjhala

We develop a prototype biofuels model focused on major cross-sectoral interactions. This is a multi-market model of economic activity with a focus on three economic sectors: electricity, transportation, and agriculture – and calibrated for the US economy. Using the model, we conduct an analysis of the interactions between policies designed to impact individual sectors and the impacts of those policies on food production, energy and environment, infrastructure, and economy at large.

3 - Biding Strategy of a Producer with Endogenous Formation of LMPs
Antonio J. Conejo, Professor, University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, antonio.conejo@uclm.es, Carlos Ruiz

This presentation considers a producer that trades electric energy in a pool, and provides a procedure to derive its optimal offering strategy considering uncertainty on both demand bids and production offers of rival producers. The proposed procedure relies on a bilevel programming model whose upper-level problem represents the profit maximization of the strategic producer while the lower-level one represents the market clearing and the corresponding price formation.

4 - Analysis of the North American Natural Gas Market Using the World Gas Model
Steven Gabriel, Dr., University of Maryland, 1143 Martin Hall, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, sgabriel@umd.edu, Ruud Egging

We provide an analysis of the North American natural gas market and by extension, impacts on Europe. We make use of the World Gas Model (WGM), a large-scale complementarity model of global gas markets in which some of the players are depicted as Nash-Cournot agents. We consider a variety of supply scenarios including: gas from Alaska, additional shale production, LNG imports and competition in the Atlantic and Pacific basins as part of our overall analysis.

■ TB30

H-Room 502, Fifth Floor

Open Pit Mine Planning, II

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

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, anewman@mines.edu

1 - Applying a Sliding Time Window Heuristic to the Open Pit Mine Block Sequencing Problem
Kelly Eurek, Graduate Student, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, keurek@mines.edu, Alexandra Newman

Using a standard integer programming formulation for the open pit mining block sequencing problem, we demonstrate the use of a sliding time window heuristic to solve a real problem instance containing tens of thousands of blocks and 20 time periods. We compare the performance of this heuristic to a standard multi-period heuristic and discuss the extent to which the resulting schedules helped management form decisions for this mine in Latin America.

2 - Short Term Mine Planning Model Supporting Geometallurgical Blending
Enrique Rubio, Universidad de Chile, Beauchef 850, Santiago, Chile, erubio@redcoglobal.com, Camilo Morales

We propose an integer programming model to determine a short term mine planning model maximizing the total fines production over 6 months subject to dynamic geometallurgical blending constraints. The proposed model has been tested at Spence mine (in which a sequential oxide, sulfide ore campaign is performed) and has been used at mine scale as guide for short term mine planners to define the best block sequencing for 6 month time periods.

3 - Risk Control in Ultimate Pits Using Conditional Simulations
Juan Pablo Vielma, ISyE, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, jvielma@isye.gatech.edu, Daniel Espinoza, Eduardo Moreno

We study how to incorporate risk control to the generation of ultimate pits when orebodies are are modeled through a finite number of conditional simulations. We consider several risk measures and incorporate them into the generation of ultimate pits by solving a stochastic programming version of the ultimate pit problem. We also study the effect of using different number of simulations in the generation and evaluation of ultimate pits.

■ TB31

H-Room 503, Fifth Floor

Decentralized Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Andrew Lim, Associate Professor, University of California (Berkeley), IEOR Department, 4177 Etcheverry Hall, University of California, Berkeley, CA, 94720-1777, United States of America, lim@ieor.berkeley.edu

1 - On a Collaborative Mechanism Based on Exchange Prices in Multicommodity Flow Networks
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu, Luyi Gui

In a multicommodity network where edge capacities and commodities are privately owned, we design a collaborative mechanism based on capacity exchange prices so as to subtly regulate the selfish behaviours of the players. We study the stability and efficiency of such price mechanisms and the fairness of the resulting payoff allocations in terms of cooperative game theory. We also consider the robustness of the mechanism by characterizing the system equilibria under data uncertainties.

2 - A Bilevel Stochastic Programming Model for Medium-term Trading for Retailers in Electricity Markets

Miguel Carrion, Dr., University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, Miguel.Carrion@uclm.es

We present a bilevel programming approach to formulate the medium-term decision-making problem faced by a power retailer. A retailer must decide its level of involvement in the futures market and the selling price offered to its potential clients. The objective of this retailer is to maximize the expected profit at a given risk level. A stochastic programming model is proposed in order to account for the uncertainty on future pool prices, client demands, and rival-retailer. Unlike previous approaches, client response to retail price and competition among rival retailers are explicitly considered in the proposed bilevel model. A realistic case study is solved to illustrate the efficient performance of the methodology proposed.

3 - Assessing Network Access Charge for New Telecommunications Services: the Korean IPTV Case

Jungsuk Oh, Associate Professor, Seoul National University, College of Business Administration, 599 Gwanangno Gwanak-gu, Seoul, 151-916, Korea, Republic of, joh@snu.ac.kr, Jung Hyun Cha, Dong Hee Kim, Soo Wook Kim

The IPTV service has been heralded as the ultimate convergence service between media and telecommunications sectors. Despite musch expectations, the commercial launch was delayed due to various disagreements. One of the biggest issues was whether and at what price the network providers have to rent their backbone infrastructure out to IPTV service providers. In this paper, a framework and a methodology for assessing the amount of access charge are presented.

■ TB32

H-Room 504, Fifth Level

Financial Engineering Methods and Applications

Cluster: Financial Engineering
Invited Session

Chair: Vadim Linetsky, Professor, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, linetsky@iems.northwestern.edu

1 - Modeling Correlated Defaults

Rafael Mendoza-Arriaga, Assitant Professor, The University of Texas at Austin, Information, Risk, & Operations Manageme, CBA 5.202, B6500. 1 University Station, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu, Vadim Linetsky

We present a novel framework for modeling correlated defaults where it is possible to capture the so-called "contagion effect". Time changing multi-parameter Markov processes with multivariate subordinators leads to jump-diffusion processes that are correlated through their jump measures. When unpredictable shocks arrive, the default intensity of multiple firms will shift simultaneously, which can trigger multiple defaults.

2 - Secured Asset Financing with Credit, Asset, and Foreclosure Risks

Steven Golbeck, PhD Student, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Rd, C210, Evanston, IL, 60208, United States of America, StevenGolbeck2008@u.northwestern.edu, Vadim Linetsky

Asset financing, such as residential and commercial real estate mortgages and heavy equipment loans and leases constitute a large and significant segment of the global debt markets. In a typical asset backed loan, the lender is exposed to the risk of default, the foreclosure risk, and the asset price risk. We develop secured asset financing models that take these risks into account.

3 - Commodity and Energy Models with Mean-reverting Jumps: A Spectral Expansion Approach

Lingfei Li, PhD student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, lingfeili2012@u.northwestern.edu, Vadim Linetsky

We construct a novel class of pure jump and jump-diffusion commodity and energy models with mean-reverting jumps by applying time changes to the classical commodity models based on mean-reverting diffusions. We obtain analytical solutions for pricing options on futures by applying the spectral expansion methodology. The models are flexible enough to capture a variety of implied volatility smile patterns observed in energy, metals, and agricultural commodities futures options.

4 - Bermudan Options Valuation in Levy Models

Liming Feng, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@uiuc.edu, Xiong Lin

In this talk, we present a transform based method for the pricing of Bermudan vanilla, barrier, and lookback options in Levy process models. Numerical results demonstrating exponential convergence of our method will be shown.

■ TB33

H-Room 505, Fifth Floor

Pricing and Inventory Issues in Product Variety Management

Cluster: Economic Models in Operations Management
Invited Session

Chair: Mehmet Gumus, Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, mehmet.gumus@mcgill.ca

1 - Assortment Planning When Consumers Have Heterogeneous Quality Preferences

Mark McElreath, PhD Student, Clemson University, 110 Freeman Hall, Clemson, SC, 29634-0920, United States of America, mmcelre@clemson.edu, Maria Mayorga

We consider the inventory management and assortment planning problems with multiple quality levels of products using a locational choice model. Customers have a heterogeneous preference for quality and are classified as either "price seekers" or "quality seekers". Our results characterize the properties of optimal assortments under these assumptions.

2 - Dynamic Pricing of Substitutable Products under Logit Demand

Minsuk Suh, UM, 1205 Beal Ave, Industrial and Operations Engineering, Ann Arbor, MI, 48109, United States of America, mssuh@umich.edu, Goker Aydin

We consider the problem of dynamically pricing two substitutable products over a finite selling season. Our model captures the effect of prices and stock-outs on customer choice. We prove monotonicity properties for the optimal price difference and the optimal purchase probabilities. We extend the results to a multi-segment problem, in which the segments differ from one another in terms of the product(s) they are considering. We study the benefits from price discriminating among the segments.

3 - Dynamic Assortment Customization with Limited Inventories

Lei Xie, PhD student, Duke University, 1st towerview, Durham, United States of America, lei.xie@duke.edu, Gurhan Kok, Fernando Bernstein

We consider a retailer with limited inventories of a category of substitutable products and heterogeneous customer preferences. Customers arrive sequentially and the firm decides which subset of the products to offer to a customer depending on the customer type, the inventory levels and the time-to-go in the season. We show that limiting the choice set of some customers can significantly increase profitability.

4 - Multi-Product Dynamic Pricing and Inventory Ordering Strategies

Mehmet Gumus, Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, mehmet.gumus@mcgill.ca

Product variety requires extensive coordination between supply and demand. To achieve this target, firms not only need to manage their prices and inventories jointly but also need to understand the impact of their pricing decisions on customers' purchase decisions in a multi-product environment. In this paper, we develop two demand models in order to capture strategic effects of product prices on purchase decisions.

■ TB34

H-Room 520, Fifth Floor

Transportation and Environmental/Societal Impact

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Theresa Barker, PhD Candidate, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@u.washington.edu

1 - Evaluating Emission Reductions and Trade-offs in Urban Pickup and Delivery Systems

Felipe Sandoval, University of Washington, 135 More Hall, Seattle, WA, United States of America, felipe7@u.washington.edu, Anne Goodchild

This research presents a novel routing and scheduling model that minimizes emissions from a heterogeneous fleet of pickup and delivery vehicles. The model has been developed to allow for study of the relationships and trade-offs between emissions, financial cost, and service quality. A specific case study which demonstrates application of the model will be presented. The model can be used to consider individual delivery fleets, and the impact of regulatory policies on these fleets.

2 - An Analysis of Train Emissions and Their Health Impacts in California's Alameda Corridor

Jean-Daniel Saphores, Associate Professor, University of California, Irvine, Civil and Environmental Engineering, Irvine, CA, 92697, United States of America, saphores@uci.edu, Rose Raymond, Stephen Ritchie, Mana Sangkapichai, Oladele Ogunseitan

The Alameda corridor is a key rail link for moving freight in and out of the Ports of Los Angeles and Long Beach but it contributes significantly to local air pollution. As a first step for understanding trade-offs between truck and rail freight transport, we analyze the emissions and the dispersion of PM and NOx emitted by train operations in the Alameda corridor, and present estimates of their health impacts. We then highlight data gaps and present difficulties encountered in our analyses.

3 - Microscopic Modeling of Air Quality Impacts of Drayage Truck Operations in the Alameda Corridor

Stephen Ritchie, Professor, University of California, Irvine, Civil and Environmental Engineering, Irvine, CA, 92697, United States of America, sritchie@uci.edu, Jean-Daniel Saphores, Mana Sangkapichai, Iris You, Gunwoo Lee, Robert Ayala

In this study we seek to develop and investigate 'microscopically-based' analysis tools that will shed light on the links between Ports of Long Beach and Los Angeles freight traffic, air pollution, and the health of local communities, and the effectiveness of alternatives to mitigate the environmental and health impacts of port activities. This presentation will discuss the results of this study to date and some of the difficulties in implementing microscopic approaches to this problem.

■ TB35

H-Sapphire A, Fourth Floor

Scheduling and Resource Allocation Applications in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu

1 - Optimal Capacity Planning for Medicaid Home and Community Based Services

Feng Lin, Weldon School of Biomedical Engineering, Purdue University, 206 S. Martin Jischke Drive, West Lafayette, IN, 47907-2032, United States of America, linf@purdue.edu, Mark Lawley, Nan Kong

An effective long-term care (LTC) provision and delivery system is critical to an aging society, especially when the payers are straining under serious financial burden. HCBS is considered as a partial solution to the expensive institutional services, but it cannot substitute institutional services completely. An optimization model is developed to determine the capacity of a HCBS program that minimizes the overall Medicaid expenditures, including expenditures of LTC services and acute care.

2 - Optimizing Provider Capacity Policies in Open Access Clinics by Considering Patient Choice

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

To improve the accessibility and reduce patient no-shows, many clinics are experimenting with open access scheduling. However, the implementations of open access scheduling prove far less successful than anticipated due to the lack of quantitative decision making tools. In this talk, we present a Markov chain model to capture open access scheduling process when considering patient choice. Using this model, we optimize provider capacity policies for a provider (team) in open access clinics.

3 - Stochastic Sequential Scheduling for Continuous Consultation Sessions with Customer No-show

Santanu Chakraborty, Purdue University, Champaign, IL, 61822, chakrabs@purdue.edu, Mark Lawley, Kumar Muthuraman

In this paper we develop a sequential scheduling algorithm for the case where the service period is not divided into slots. We assume that the service time distribution is exponential and each customer has a certain probability to no-show. We prove that the expected cost is a convex function of appointment time. Computational results show that the this method yields higher expected profit and less overtime compared to a situation where service period is divided into slots of standard length.

■ TB36

H-Sapphire B, Fourth Floor

Optimization in Radiotherapy III

Sponsor: Health Applications
Sponsored Session

Chair: Allen Holder, Rose-Hulman Inst. of Tech., 5500 Wabash Ave., Terre Haute, IN, 47803, United States of America, holder@rose-hulman.edu

1 - Dosimetry Robustness with Stochastic Optimization

Omid Nohadani, MIT, 77 Massachusetts Ave, E40, Cambridge, MA, 02139, United States of America, nohadani@mit.edu, Joao Seco, Thomas Bortfeld

All radiation therapy planning rely on dose calculation. Dosimetric and imaging uncertainties can degrade an otherwise optimal plan. We present a robust optimization method which handles dosimetric errors and warrants for high-quality Monte Carlo based IMRT plans. We demonstrate it on a clinical lung cancer case and show that the plans are more robust against errors and are clinically acceptable. They exhibit a two-fold improved equivalent uniform dose and a significant computational speed-up.

2 - Optimization Models for Leksell Gamma Knife Perfexion Treatment Planning

Hamid Ghaffari, University of Toronto, 5 King's Collage Road, Toronto, ON, M5S3G8, Canada, ghaffari@mie.utoronto.ca, David Jaffray, Dionne Aleman, Mark Ruschin

Stereotactic radiosurgery (coined Gamma Knife by Elekta) has been used to treat brain tumors and lesions for four decades. Perfexion is the newest generation of Elekta's Gamma Knife machines, and allows for the size and shape of each radiation shot to be dynamically changed, as well as for the position of the patient to be moved in three dimensions. We present an optimization model that fully incorporates the capabilities of Perfexion units. Performance results using test data are presented.

3 - Unifying Radiotherapy Design with Fourier Solutions

Allen Holder, Rose-Hulman Inst. of Tech., 5500 Wabash Ave., Terre Haute, IN, 47803, United States of America, holder@rose-hulman.edu, Vicky MaK

Optimizing radiotherapy treatments is traditionally segmented into three separate problems, but unified models are emerging due to advanced solution methods. We propose a simple, unified model and a solution method based on Fourier series. Such solutions innately limit treatment time and simultaneously satisfy dose limitations.

■ TB37

H-Sapphire C, Fourth Floor

Birthday Session for Warren Hausman and Bob Carlson

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Candi Yano, UC Berkeley, IEOR Department and Haas Sch. of Bus., Berkeley, CA, 94720, United States of America, yano@ieor.berkeley.edu

1 - OR and BI: Leveraging the Power of In-Database Analytics

Anne Robinson, Sr. Manager, Information and Data Strategy, Cisco, 170 West Tasman Drive, San Jose, CA, 95134, United States of America, annerobi@cisco.com, Blake Johnson

The complexity of Operations Research has traditionally limited its application to specialized problems or blackbox software. Recent advances to put predictive and optimization modeling capabilities within enterprise data warehouses (EDW) enables new avenues for OR analysts. By combining the power of the EDW, math models, and Business Intelligence (BI) technologies, OR can be applied and disseminated to a much broader audience in a more robust format, enabling true intelligence for the business.

2 - A Central Warehouse with a Dual Role in the Supply Chain

Kyle Cattani, Associate Professor, Kelley School of Business, Indiana University, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, kcattani@indiana.edu, F. Robert Jacobs, Jan Schoenfelder

Using data from a Midwest-based company, we evaluate the efficacy of traditional analytic models in terms of determining effective inventory policies for an arborescent supply chain where the central warehouse not only serves to replenish other warehouses, but also meets demand from nearby end customers. We find that traditional modeling assumptions of a strictly arborescent structure as well as the assumptions about demand distributions impede usefulness of traditional models.

3 - Supply Chain Finance: Issues, Models and Results
Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu

This presentation will provide a quick overview of recent research activity in better understanding issues of financing in capital constrained supply chains and their effects on inventories,retail ordering behavior, and overall supply chain efficiency.We will discuss the role of bankruptcy risks and costs on supply chain decisions,and outline future research directions.

4 - Pareto-Improving Manufacturer Pricing Policies When Consumers Stockpile
Candi Yano, UC Berkeley, IEOR Department and Haas School of Business, Berkeley, CA, 94720, United States of America, yano@ieor.berkeley.edu, Daphne Qi

Transportation economies of scale encourage retailers to place large orders infrequently, which then provides an incentive for them to offer retail discounts to clear inventory more quickly when consumers are prone to stockpile. We consider the effects of the retailer's pricing policy (high-low versus everyday low price) on the consumers' willingness to pay in this context, and show when and how a manufacturer can adjust his price structure to achieve Pareto-improving outcomes.

■ TB38

H-Sapphire D, Fourth Floor

Topics in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Nesim Erkip, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, nesim@bilkent.edu.tr

1 - Competitive Production Planning under Yield and Demand Uncertainty
Melike Baykal-Gursoy, Associate Professor, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu, Sara Ghorbani

We consider a market in which two retailers are planning their production level competitively in selling substitutable products such as olive oil and orange juice. We assume that retailers first lease farm land to grow olives or oranges, and then after observing the yield, decide on the production level. The market price of the product depends on the yield of both retailers. We show that there exists a unique equilibrium pair for both retailers.

2 - Integral Capacity and Inventory Decision Making in a Simple Production System
Nico Dellaert, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, Netherlands, N.P.Dellaert@tue.nl, Tarkan Tan, Simme Douwe Flapper, Jully Jeunet

This paper deals with the integral acquisition of capacity and material in a situation with uncertain demand, with non-zero lead-times for the supply of both materials and capacity. By using a DP formulation, we will describe the optimal balance between using safety stocks and contingent workforce. We will compare the optimal strategy with the standard inventory approach and derive characteristics that can provide a thorough basis for operational decision making.

3 - Optimal Sourcing Decisions Under Alternative Capacitated Suppliers
Tarkan Tan, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Pav F7, Eindhoven, 5600 MB, Netherlands, t.tan@tue.nl, Osman Alp

We consider sourcing decisions for a single item with stochastic demand. This item can be produced or supplied by a number of capacitated facilities ('sources'). We associate a separate fixed cost for initiating the usage of each source. We build a novel pseudo-polynomial dynamic programming model that we use for finding the solution to this NP-hard problem in one shot. We also propose a simple heuristic and build managerial insights, some of which are contrary to the collective intuition.

4 - A Final Phase Inventory Problem
Nesim Erkip, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, nesim@bilkent.edu.tr, Murat Fadiloglu, Onder Bulut

We consider a final phase inventory problem for a component that is no longer used as an input for manufacturing, but continues to experience stochastic demand during the warranty period. The supplier no longer receives the same economic value for the manufacturing of this component, as volume has decreased. We model the spare part inventory problem to reflect the behavior of the supplier and propose ways of renewing the agreement between the manufacturer and spare part distributor.

■ TB39

H-Sapphire E, Fourth Floor

Operations Models in Healthcare

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Burhaneddin Sandikci, Assistant Professor, The University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, burhaneddin.sandikci@chicagobooth.edu

1 - Rational Consumer Behavior in Influenza Vaccine Supply Chain
Sarang Deo, Assistant Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, s-deo@kellogg.northwestern.edu, Seyed Iravani, Kenan Arifoglu

We develop a newsvendor-like model for the influenza vaccine supply chain by including rational decision making by customers and manufacturer in the presence of yield uncertainty and negative externality due to infection dynamics. We find contrary to the existing economic models, that the expected demand in equilibrium can be higher than the socially optimal demand. We also characterize the gap between the social optimum and the equilibrium solution and discuss various coordinating mechanisms.

2 - New Inventory Policies in Healthcare: Taking Advantage of Technology
Claudia Rosales, University of Cincinnati, QAOM Dept, Business School, Cincinnati, OH, 45221, United States of America, rosalecr@email.uc.edu, Uday Rao, Michael Magazine

Healthcare providers are investing in new technology to improve availability of supplies and reduce total costs, allowing the use of inventory policies not previously considered. We study a hybrid inventory policy that combines the advantages of periodic replenishment, to achieve economies of scale, with the flexibility of out of period replenishments to respond to imminent stockouts. We discuss the benefits of this new policy versus traditional policies under single and multiple item scenarios.

3 - Mechanism Design in Organ Allocation
Stefanos Zenios, Stanford University, Graduate School of Business, Stanford, CA, 94305, United States of America, stefzen@GSB.Stanford.Edu, Anicham Kumarasami, Yichuan Ding

We will review two recent proposals to modify the kidney allocation system in the United States and discuss potential unintended consequences due to patient and physician self-interested behavior. We will outline preliminary models that can be used to capture these consequences and derive system design recommendations.

4 - Estimating the Value of the Liver Transplant Waiting List Information
Burhaneddin Sandikci, Assistant Professor, The University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, burhaneddin.sandikci@chicagobooth.edu, Lisa Maillart, Andrew Schaefer, Mark S. Roberts

The end-stage liver disease patients in the United States receive cadaveric liver transplants through joining a waiting list (WL). Patients on the WL are faced with the problem of accepting or rejecting an offered liver. We analyze this decision problem by formulating Markov decision process models and investigate the value of accessing WL information. We compare three models, assuming complete, partial, and no WL information, and present clinically driven numerical results.

■ TB40

H-Sapphire H, Fourth Floor

Capacity Allocation Among Multiple Demand Classes

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Ying Li, Assistant Professor, Texas A&M University, Mays Business School, College Station, TX, 77843, United States of America, yli@mays.tamu.edu

1 - Pricing, Scheduling and Admission Control: A Mechanism Design Approach
Max Shen, Professor, University of California-Berkeley, Dept of IEOR, Berkeley, CA, 94704, United States of America, shen@ieor.berkeley.edu, Tingting Cui, Ying-Ju Chen

We study a problem setting in which a capacity-constrained service provider modeled as an M/M/1 queueing system intends to serve several segments of customers. Customers are heterogeneous in their willingness to pay and their willingness to wait, both of which are private information. We show that a well-designed menu of admission control along with priority pricing contracts may force customers to reveal their true valuations and at the same time maximize the expected revenue for the server.

2 - Analysis of a Capacitated Make-to-order Production System with Two Products

Suleyman Demirel, PhD Candidate, University of Michigan, 701 Tappan Ave, Ann Arbor, MI, 48104, United States of America, sdemirel@umich.edu, Roman Kapuscinski, Izak Duenyas

We consider a manufacturer that stocks major sub-assemblies in stock and assembles products to order. We consider two products with their respective major sub-assemblies supplied by two outside suppliers. Suppliers face finite production capacity and the manufacturer faces a finite assembly capacity. We discuss the the optimal policy for the lost sales case and near-optimal policies for the backlogging case.

3 - Adaptive Capacity Allocation Systems

Wen-Ya Wang, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, wenya@ie.umn.edu, Diwakar Gupta

We develop a framework for the design of the next generation of appointment systems that dynamically learn and update customer preferences and use this information to continuously improve appointment-booking decisions. We apply these ideas to the design of appointment systems for primary-care clinics and report results from numerical experiments.

4 - A Remanufacturing Inventory System with Lost Sales: Push, Pull and Hybrid Strategies

Justin Jia, Penn State University, 483A Business Building, University Park, PA, 16802, United States of America, zuj100@psu.edu, Daniel Guide, Susan Xu

We study a single-product periodic-review inventory system, in which a firm remanufactures returned products of heterogeneous qualities to meet demand for refurbished items. Remanufacturing takes a unit time and incurs a quality-dependent production cost. Unmet demand is lost. We investigate the Remanufacture-to-Stock (RTS), Remanufacture-to-Order (RTO), and hybrid RTS/RTO strategies, derive structural properties of the optimal decision rules, and develop efficient solution algorithms.

5 - Prioritizing Regular Orders While Reserving Capacity with Emergency Demands

Xinxin Hu, Assistant Professor, Indiana University, 1309 East 10th Street, Bloomington, IN, 47405, United States of America, hux@indiana.edu, Ying Li, Eunshin Byon, Barry Lawrence

We consider a capacity reservation problem faced by an oil service and equipment company which offers the different types of products and routinely faces emergency orders. In a multiple period dynamic setting, we propose the structured optimal policy about how to reserve regular capacity for the coming uncertain emergent orders, which have to be fully satisfied with the help of expensive safety capacity, as well as how to allocate the remaining capacity among the different regular products.

■ TB41

H-Sapphire L, Fourth Floor

Service to Manufacturing

Contributed Session

Chair: Valerie C. Y. Zhu, PhD, The School of Management of Xi'an Jiao Tong University, No. 28, West of Xian Ning Road, Xi'an, 710049, China, valeriezhu@mail.xjtu.edu.cn

1 - Model Development for Production of Critical Flashover (CFO) Voltage of Various Material Combination Used in Power Distribution System

Mohammad Quasem, Associate Professor, Howard University, Washington, DC, 200059, United States of America, mquasem@howard.edu

In this study, FRP polymer and wood add to the classic porcelain insulation. The impact of the assembly of the materials has been observed. Four sets of two component materials and combinations of their components in series has been tested. Finally predictions of insulation strength have been made on how one component would supplement another. This study may be helpful in obtaining optimal choice of diolectrics used on power distribution system.

2 - The Service Transformation of Chinese Product Manufacturing Companies in the Financial Crisis

Ding Wei, Xi'an JiaoTong University, Mailbox 1888, Xian JiaoTong University, Xi'an, 710049, China, weidingxjtu@gmail.com, Zhe HE

Manufacturing industry has being the main driving force of China's economy, though it faces: low value-added products and irrational industry structure. The impact of financial crisis forces us to reconsider its developing mode. By extending enterprises' value chains and promoting the product value-added, service transformation has become more and more important to the manufacturing companies in China. This paper focuses on identifying the strategies of companies' service transformation.

3 - Measurement, Character and Changing Trend of China's Manufacturing Regional Specialization

Anbo Wu, School of Management, Xi'an Jiaotong University, P.O.Box 1888,No.28, Xianning West Road, Xi'an, SX, 710049, China, brenda8616@gmail.com

This study measures regional specialization(RS) degree of China's 29 provinces and 18 manufacturing industries from 1988 to 2006 by using RS coefficient constituted by Fan(2007). And the study analyzes character and changing trend of China's RS. Results show overall RS degree of China's manufacturing industry increased annually. 4 industries' degrees are higher than others. Specialized work division is enhanced. Structural heterogeneity of industries between provinces continuously ascends.

4 - Optimal Selections for Foundry and Fabless with Demand and Coverage Considerations

Zehra Bilginturk Yalcin, University of Texas at Austin, University Station 1, C2200, Austin, TX, 78703, United States of America, zbilginturk@yahoo.com

We examine two problems that arise in semiconductor manufacturing industry. Foundry selection and demand coverage problem looks at the system from fabless company's point of view and is concerned with optimally selecting a set of foundries to satisfy the demand coming from a range of markets while minimizing total cost. Fabless selection and capacity allocation problem, on the contrary, is interested in foundry's problem of fabless company selections and scheduling of selected customer orders.

5 - Insights into Operations Management

Valerie C. Y. Zhu, PhD, The School of Management of Xi'an Jiao Tong University, No. 28, West of Xian Ning Road, Xi'an, 710049, China, valeriezhu@mail.xjtu.edu.cn, Lin'yan Sun

This paper offers insights into the research of operations management in service-manufacturing—-a new "industry" with a close marriage between service and manufacturing. The concept of service-manufacturing has been iterated; the value creation and aggregation model in service-manufacturing has been demonstrated; the theoretical framework and the research agenda of operations management in service-manufacturing have been illustrated.

■ TB42

H-Sapphire P, Fourth Floor

SCM for Make-to-Order Products

Contributed Session

Chair: Jooyol Maeng, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States of America, maengjy@purdue.edu

1 - Engine Build Model for Aircraft Engines at United Airlines

Kumar Satyam, Senior Analyst, United Airlines, 1200 E Algonquin Road, Elk Grove Township, IL, 60007, United States of America, kumar.satyam@united.com, Feryal Kuran

This model determines the target life cycle an aircraft engine should be built to during maintenance visits to minimize the total cost associated with engine. Further, the model optimizes assignment of available parts across different engines for a time period based upon various related business policies.

2 - Optimal Bulk to Case Product Mix in a Supply Chain

Jooyol Maeng, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States of America, maengjy@purdue.edu

The study is on a leading wine bottle manufacturer that provides a high level of customization and services for its customers. It operates under the make-to-order system, but the highly volatile nature of demand on wine industry often creates a huge discrepancy between sales orders and actual demands, which results in frequent order cancellations. The characteristic of items with poor forecast is investigated in the study.

3 - A Strategic Design of a Traditional Channel: The Entry of Direct Online Sale and the MSRP

Zhaoqiong Qin, Associate Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro NC 27411, United States of America, zqin@ncat.edu

This paper investigates the effect of two strategies including the entry of a direct channel and the MSRP (manufacturer's suggested retail price) on the "double marginalization" compared to the decentralized traditional channel. Our results show that both strategies can help to relieve the "double marginalization". Furthermore the degree of the relief depends on the values of the parameters in the study.

■ TB43

H-Room 400, Fourth Floor

Managing Uncertainty in Supply Chains

Cluster: Supply Chain Models
Invited Session

Chair: Nan Yang, Assistant Professor, Cornell University, ny38@cornell.edu

1 - Balancing Learning and Economies of Scale: The Adaptive Clinical Trial Case

Yao Zhao, Associate Professor, Rutgers University, 180 University Ave, Newark, NJ, United States of America, yaozhao@andromeda.rutgers.edu, Adam Fleischhacker

In clinical trials, drug candidates may experience significant uncertainties in demand due to the unknown dosage and number of patients. However, most of these factors can be learned during the trial. To take advantage of this learning, intra-trial batches can be produced, but at the expense of scale economies. Under various learning curves, we study this balance between learning and economies of scale to optimally schedule and size production.

2 - Trade Credit and Supply Chain Management

Min Wang, Columbia University, 2960 Broadway, New York, NY, 10027, United States of America, mwang13@gsb.columbia.edu, Awi Federgruen

In this paper, we analyze decentralized supply chain arrangements involving a supplier and one or several buyers. To stimulate demand and overcome credit limitations experienced by the buyers, the supplier sells the goods on consignment, demanding invoice payment along, with general credit charges, only at the time goods are sold by the buyer. We provide systematic comparisons with the traditional supply chain models in which buyers pay for their purchases upon delivery or shipment of the goods.

3 - Managing Random Disruptions of Random Duration

Tony Arreola-Risa, Associate Professor, Texas A&M University, INFO Department, Mays Business School, College Station, TX, 77843-4217, United States of America, A-Arreola-Risa@mays.tamu.edu, William Stein

We study a production-inventory system with stochastic demands and manufacturing times, where the manufacturing process experiences random disruptions of random duration. The inventory is managed by a base-stock policy. The objective is to find the optimal base-stock level.

4 - Matching Supply and Demand in the Presence of Multiclass Suppliers and Customers

Long Gao, Assistant Professor, University of California, Riverside, CA, long.gao@ucr.edu, Nan Yang

We study a multiperiod supplier selection and order acceptance problem in the presence of multiclass suppliers with random yields and random demands from multiclass Customers. We characterize the structure of the optimal policy and investigate the impact of system parameters. We numerically compare the performance of several widely used policies with that of the optimal policy under different scenarios, and provide recommendations for the management.

5 - Optimal Order and Effort Decisions in the Newsvendor Model

Charles Wang, SUNY Buffalo, School of Management, Buffalo, NY, United States of America, cxwang@buffalo.edu

In this paper we consider a newsvendor who sells a short life-cycle product with uncertain and effort-dependent demand. We derive the optimal order and sales effort decisions in the newsvendor model and provide some managerial insights.

■ TB44

H-Room 402, Fourth Floor

Uncertainty Management in Services

Sponsor: Service Science
Sponsored Session

Chair: Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

1 - Stochastic and Determenistic Processes in Ambulatory Care Affecting Quality of Care

John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

Ambulatory care, like most service industries, cannot meet changes in demand through inventory. The co-production of value is strongly constrained and controlled by 2 interacting processes: predicting and meeting service demand and understanding and controlling patterns. We will present analysis and subsequent applied solutions affecting quality of care in Emergency Departments, Primary and Specialty Care settings.

2 - Techniques for Reducing Uncertainty

Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

We define uncertainty as the difference between information needed versus the information we actually have to complete a task or to make a decision. Managing uncertainty are the methods, processes, and tools to reduce this information gap. We present and discuss the difference between uncertainty and risk. We present a number of ways to manage some key uncertainties in services.

3 - Uncertainty-aware Service

Genady Grabarnik, Scientist, Ritesoft, 126 Brambach Rd, Hawthorne, NY, 10532, United States of America, genadyg@gmail.com, Larisa Shwartz

Service, as a co-production of provider and consumer, is a reactive system that constantly interacts with its environment by reaching to incoming stimuli that may arrive at any stage of the service life cycle. However, risk identification and assessment in services is mostly static and custom built on the data that gathered manually using techniques that relevant for individual service; the existing tools for service design and planning don't have meaningful mechanisms for managing uncertainty.

■ TB45

H-Room 410, Fouth Floor

Perspectives on Product Development Challenges

Cluster: New Product Development
Invited Session

Chair: Stylianos Kavadias, Associate Professor, Georgia Institute of Technology, 800 W. Peachtree Street, Atlanta, GA, 30308, United States of America, Stylianos.Kavadias@mgt.gatech.edu

1 - Design and Introduction of Conspicuous Durable Products

Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, 30308, United States of America, vishal.agrawal@mgt.gatech.edu, Stylianos Kavadias, Beril Toktay

We study the implications of exclusivity-seeking consumer behavior (snob effect) on the durability and pricing choices of the firm. There is an extensive body of literature that argues for the benefit of designing products with low durability (planned physical obsolescence). We show that in presence of exclusivity-seeking consumer behavior, firms should design products that undergo slow value erosion coupled with a high-price, low-volume product introduction strategy.

2 - Launching a Thousand Ships: Incentives for Parallel Innovation

Florian Ederer, Assistant Professor, UCLA Anderson, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, ederer@mit.edu

In a setting where workers can freely exchange ideas under-exploration may result as workers free-ride. Optimal incentives for routine activities take the form of individual pay-for-performance, while for parallel innovation they tolerate early failure and provide long-term group incentives for joint success. Using data from a laboratory experiment I show that this link is causal. Innovation success is highest when subjects receive a group incentive scheme that rewards long-term joint success.

3 - The Impact of Different Types of Input in the Design of Assistive Technology Products

Young-Mi Choi, Ph.D. Candidate, Center for Assistive Technology and Environmental Access (CATEA), 490 Tenth Street, Atlanta, Atlanta, GA, 30332-0156, United States of America, christina.choi@gatech.edu

One of the challenges facing developers of new Assistive Technology (AT) products is in utilizing input gathered from end users during the design process to gain a full understanding of their needs. A controlled design study was undertaken to measure how different types of input (from end users, therapists and simulation) during the design process affect the level of satisfaction and effectiveness of the finished AT product. The goal is to identify possible ways to improve the design process.

■ TB46

H-Room 411, Fourth Floor

Vehicle Routing and Uncertainty

Sponsor: Technology Management
Sponsored Session

Chair: Tom Van Woensel, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav F5, Eindhoven, Netherlands, t.v.woensel@tue.nl

1 - Multi-Objective Time-Dependent Capacitated Vehicle Routing Problem with Time Windows
Said Dabia, Eindoven University of Technology, PostBus 513, Eindhoven, Netherlands, s.dabia@tue.nl

A limited fleet of vehicles serve a set of geographically scattered customers. Every vehicle has a finite capacity and limited time availability, and is allowed to make several tours during its operating period. Travel times are time-dependent and all customers need to get delivered in their specific time windows. We aim to minimize the total time travelled including any waiting times, while the total quantity delivered is maximized. Efficient dynamic programming algorithms are developed.

2 - Dynamic Routing Using Real-time ITS Information
Ali R. Guner, Research Assistant, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, arguner@wayne.edu, Ratna Babu Chinnam, Alper Murat

Growing travel time delays and variability in transportation networks are negatively impacting the efficiency of JIT logistics. Recurrent congestion is one of the primary reasons for delivery delay and variability. We model the problem as a time dependent TSP and propose a stochastic DP formulation for dynamic routing of a vehicle in non-stationary stochastic networks subject to recurrent congestion. Results are tested in a network of Southeast-Michigan using historical ITS data.

3 - Consistent Vehicle Routing with Stochastic Customers: A Stochastic Programming Formulation
Ola Jabali, PhD Student, Technische Universiteit Eindhoven, Den Dolech 2 Pav. E.17, P.O.Box 513, Eindhoven, 5600 MB, Netherlands, o.jabali@tue.nl, Rei Walter, Tom Van Woensel, Ton de Kok, Michel Gendreau

We consider the consistent vehicle routing problem, in which customers are stochastic with respect to their occurrence. For these customers we want to provide consistent service, this is insured by having the same driver visit a customer when it requests service. Furthermore, for each customer we set a target arrival time. Realized deviations from the targets are penalized . We propose a stochastic programming approach, where the sequence and the targets are set in an a priori manner.

4 - Reliability in Vehicle Routing with Time Windows
Tom Van Woensel, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav F5, Eindhoven, Netherlands, t.v.woensel@tue.nl, Nico Dellaert, Duygu Tas

A vehicle routing problem is considered where reliability is considered important. Delivery reliability becomes more and more an order qualifier which is reflected by the customer's time windows. We consider stochastic travel time distributions, analyze the propagation through the network and the interplay with the customer's time windows. The value to the reliability of using these distributions in VRPTW is discussed and demonstrated on a number of instances.

■ TB47

H-Room 412, Fourth Floor

Teaching Service Supply Chain Management: Curriculum and Methods

Cluster: Global Sourcing of Services
Invited Session

Chair: Morgan Swink, Professor, Michigan State University, Broad College of Business, Department of SCM, East Lansing, MI, 48824, United States of America, swink@bus.msu.edu

1 - Global Outsourcing of Professional Services
Natalia Levina, Associate Professor, NYU, Kaufman Management Center, 44 West 4th Street, Room 8-78, New York, NY, 10012, United States of America, nlevina@stern.nyu.edu

I will overview the objectives, syllabus, teaching methods, and exercises that I use in an MBA course on Global Outsourcing Strategy at New York University, Stern School of Business. I will also talk about the evolution of the course over 5 years that I have been teaching it.

2 - Designing a Graduate Supply Chain Management Course
Terry Harrison, Professor of Supply Chain and Information Systems, Penn State University, 459 Business Building, University Park, PA, 16802, United States of America, tharrison@psu.edu

I describe the design of a required MBA-level supply chain management course and how it has evolved over time. In particular, I emphasize efforts to make supply chain management principles relevant and interesting to a non-supply chain oriented student. I conclude by participating in a panel discussion on relating these course design ideas to the development of a services supply chain course.

3 - Teaching Service Supply Chain Management and OM Concepts in an EMBA Course
Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

Teaching Service Supply Chain Mgt and OM Concepts in an EMBA Course The presenter has taught the core POM course for the EMBA program jointly offered by Cornell and Queens University for the last two years. This course is delivered by synchronous media at over 10 locations in US and Canada. We will discuss the some of the unique aspects of teaching a service and supply chain-focused course in this environment.

■ TB48

H-Sapphire Green Room, Fourth

Empirical Studies in Service Operations

Cluster: Service Operations Management
Invited Session

Chair: Carrie Queenan, University of Notre Dame, 379 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, c_queenan@nd.edu

1 - Implications of Zones of Tolerance on Service Quality
Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 117B Sirrine Hall, Clemson, SC, 29631, United States of America, gulruo@clemson.edu, Janis Miller, Jason Thatcher

We explore the concept of Zones of Tolerance (ZOT) for service quality. ZOT suggests individuals anticipate different levels of service quality at different price points. We examine the tradeoff between meeting, versus exceeding customers expected levels of satisfaction based on two metrics of firm performance - short term profits and long term customer retention. Our focus is to examine how overall service performance contributes to sustained competitive advantage of service organizations.

2 - Habitual Citizenship Behavior
Reidar Hagtvedt, University of Alberta - School of Business, 2-43 Business Building, Edmonton, Alberta, Canada, hagtvedt@ualberta.ca, Kenneth L. Schultz, Nicola T. Shaw, Sarah Forgie, Gregory Todd Jones

Habitual Citizenship Behavior (HCB) is our generalization of hand-hygiene behavior in hospitals. Compliance with regulations is low, in spite of wide-spread hospital-acquired infections. Hand-hygiene is low cost, no risk to the health care worker, usually of no impact on the patient, but when there is an impact, the outcome is often catastrophic. We deployed a survey to map the relevant psychological constructs, and an observational study for the habitual aspects of compliance.

3 - Which Comes First, Technology or Performance? Technology's Temporal Effect in Healthcare
Carrie Queenan, University of Notre Dame, 379 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, c_queenan@nd.edu, Sarv Devaraj, Corey Angst

We often assume that technology investment unidirectionally drives more efficient organizations. However, an organization needs capital to invest in technology, which could come from more efficient organizations. Which comes first? Using Granger causality methodology, we investigate this question when implementing CPOE in a hospital setting. This study contributes to the literature by investigating the business value of CPOE and the temporal question of 'which comes first'?

■ TB49

H-Room 300, Third Floor

Transportation and Coordination to Manage Supply Chain Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Sanjay Kumar, Penn State Erie, 5101 Jordan Rd., Erie, PA, 16563, United States of America, sxk89@psu.edu

1 - Supply Chain Disruption and Recovery by Coordination
Vivek Mahanta, PhD Candidate, Drexel University, Department of Decision Science, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, vsm24@drexel.edu, Seung-Lae Kim

Disruptions in an n-supplier-m-retailer supply chain can take time and cost to recover and return to profitability. In this paper we consider coordination models under buyback, revenue sharing and quantity discount contracts to compare which models foster faster recovery. Simulation studies are conducted to validate the results.

2 - Real-Time Planning with Coordination Under Uncertainty
Nalan Gulpinar, Associate Professor, The University of Warwick, Warwick Business School, Coventry, CV6 1PY, United Kingdom, Nalan.Gulpinar@wbs.ac.uk, Ethem Canakoglu

Autonomous systems require real-time decision making capabilities for adaptive mission planning in dynamic and uncertain environment. Planning and coordination are essential for team management to achieve specific goals and have significant impact on team performance. In this paper we introduce a real-time planning framework that integrates team composition and coordination under uncertainty.

3 - Benefit-cost Analysis of Railroad Infrastructure Improvement to Reduce Transportation Risk
Xiang Liu, Graduate Research Assistant, University of Illinois at Urbana Champaign, B-118 Newmark Civil Engineering Lab, 205 N Mathews Ave., Urbana, IL, 61801, United States of America, liu94@uiuc.edu, Christopher P.L Barkan

We are developing a framework to assess the cost effectiveness of railroad infrastructure improvement to reduce transportation risk. Improved railroad track condition reduces accident probability but increases capital and maintenance costs. Our model is intended to consider the trade-off between reduced accident rates and increased costs in evaluating railroad risk-reduction strategies and operational decisions.

■ TB50

H-Room 302, Third Floor

Managing and Structuring Services

Sponsor: MSOM/ Service Management
Sponsored Session

Chair: Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu

1 - Cheap Talk in Queues
Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Achal Bassamboo

Delay announcements informing customers about anticipated delays are prevalent in service-oriented systems. How delay announcements can influence customers in service systems is a complex problem. We examine this problem of information communication by considering a model in which both the firm and the customers act strategically: the firm in choosing its delay announcement while anticipating customer response, and the customers in interpreting these announcements.

2 - Dynamic Pricing and Bayesian Learning of Customer Time-Sensitivity in Queues
Philipp Afeche, University of Toronto, Rotman School, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, afeche@rotman.utoronto.ca, Baris Ata

Virtually the entire revenue management literature for queues assumes that providers know the distribution of customer demand attributes. We relax this assumption and consider the case of unknown customer impatience. We characterize the dynamic pricing policy that optimally trades off revenue generation and learning customer demand.

3 - Coexistence of Selling and Renting in a Durable Goods Market
Haoying Sun, Doctoral Student, McCombs School of Business, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, Haoying.Sun@phd.mccombs.utexas.edu, Steve Gilbert, Ramandeep Randhawa

We consider a durable goods retailer that serves consumers who have different usage frequencies. We examine the trade-offs between selling the durable and renting it, one use at a time. While selling minimizes transaction costs, renting provides a more efficient allocation of the available products. Focusing on these trade-offs we identify conditions under which the retailer should only sell, only rent, or offer a combination of sales and rentals.

4 - Process and Contract Design When Outsourcing a Two-Level Service Process
Hsiao-Hui Lee, Simon School, University of Rochester, University of Rochester, Rochester, NY, 14627, United States of America, hsiao-hui.lee@simon.rochester.edu, Edieal Pinker, Robert Shumsky

We consider a two-level service process with the first level as a gatekeeper for the second level. We study the outsourcing of this process including, which part to outsource (first level, second level, or both) as well as the contract design. We derive conditions for the existence of system optimal coordinating contracts and explore how labor cost savings influence optimal outsourcing.

■ TB51

H-Room 303, Third Floor

Computational Integer Programming

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster Computing)
Sponsored Session

Chair: Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca

1 - Valid LP Bounds for Exact Mixed Integer Programming
Daniel Steffy, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30308, United States of America, dsteffy@isye.gatech.edu, William Cook

Successful approaches have recently been developed to efficiently solve LPs exactly and a current research focus is to solve MIPs exactly. Solving an exact LP at each node of the B&B tree is computationally expensive and can often be avoided when valid bounds can be computed. We present a new method for generating valid LP bounds without solving exact LPs. The method relies on repairing approximate LP solutions and extends some current methods by not requiring upper and lower variable bounds.

2 - A Pseudocost-based Tree Size Estimation Method for Mixed Integer Programs
Jeff Linderoth, University of Wisconsin, 1513 University Ave, 3226 Mechanical Engineering Building, Madison, WI, United States of America, linderot@cae.wisc.edu, Wasu Glankwamdee

We describe a mechanism to estimate the size of the search tree resulting from a branch-and-bound method for solving mixed integer programs. Pseudocosts are used as a key ingredient in estimation procedure. The method can be used as the branch and bound search progress, does not require knowledge of feasible solution values in order to make estimates, and should be easily implementable in any mixed integer programming solver. Computational results will be given.

3 - Generating Multiple Rounds of Rank-1 GMI Cuts
Marcos Goycoolea, Universidad Adolfo Ibañez, Avda. Diagonal Las Torres 2640, Penalolen, Santiago, Chile, marcos.goycoolea@uai.cl, Sanjeeb Dash

Gomory mixed-integer (GMI) cuts are among the most effective cutting planes for general mixed-integer programs (MIP). They are traditionally generated from an optimal basis of the initial linear programming (LP) relaxation of an MIP. We propose a heuristic to generate additional useful rank one GMI cuts from other bases of the initial LP relaxation. Extending our technique we show how to generate globally valid GMI cuts from nodes of a branch-and-bound tree.

4 - Gurobi MIP Solver
Zonghao Gu, Gurobi Optimization Inc., 4050 Walnut Creek Trail, Alpharetta, GA, 30005, United States of America, gu@gurobi.com, Robert Bixby, Ed Rothberg

First we will briefly describe the design of the algorithmic framework, which has been built from the ground up to provide maximum flexibility in exploiting modern strategies for solving mixed-integer programs. Then we will discuss our approaches to handling the key MIP issues, such as cutting planes, search, heuristics and presolve. Finally, we will present computational results about the Gurobi MIP solver.

■ TB52

H-Room 304, Third Floor

Operations Management/Marketing Interface

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Lauren Xiaoyuan Lu, Assistant Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, Lauren_Lu@unc.edu

1 - Durable Products, Time Inconsistency and Lock-in
Sree Jonnalagedda, Doctoral Student, UT Austin, McCombs school of Business, Austin, TX, 78712, United States of America, sree.jonnalagedda@phd.mccombs.utexas.edu, Steve Gilbert

For durable products that require a contingent consumable, firms may lock-in consumers by making their products incompatible with non-proprietary consumables. Under lock-in, strategic consumers anticipate higher prices for the contingent consumable. However, we show that lock-in also reduces the firm's incentive to reduce the price of its durable over time. Thus, it mitigates time inconsistency, and may either increase or decrease consumers' willingness to pay for the durable.

2 - Strategic Role of In-house Procurement Capability When Production is Outsourced
Stephen Shum, Hong Kong University of Science & Technology, School of Business and Management, Clear Water Bay, Hong Kong - ROC, sshum@ust.hk, Ying-Ju Chen, Wenqiang Xiao

We investigate the impact of a firm's procurement capability on the supply chain efficiency in the context of outsourcing. Specifically, an original equipment manufacturer (OEM) relies on a contract manufacturer (CM) to assemble her products that require a critical component from outside suppliers. We study two scenarios, depending on whether the OEM has in-house procurement capability, and characterize the OEM's optimal procurement and contracting decisions.

3 - Implications of the Long Tail Effect
Tom Tan, Doctoral Candidate, The Wharton School, University of Pennsylvania, fangyun@wharton.upenn.edu, Serguei Netessine

The Long Tail effect is a new demand pattern resulting from the Internet impact; people show a propensity to consume more niche products, thus causing the tail of the demand distribution to grow longer and fatter. In this talk we discuss empirical evidence for and against the Long Tail effect as well as demonstrate analytical approaches to modeling its consequences.

4 - Design Outsourcing in a Differentiated Product Market: The Role of Bargaining and Scope Economies
Lauren Xiaoyuan Lu, Assistant Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, Lauren_Lu@unc.edu, Annabelle Feng

During the last two decades, original equipment manufacturers (OEMs) gradually extended their outsourcing activities beyond manufacturing and outsourced product design and development to original design manufactures (ODMs). This new outsourcing model shifts the control of product design from an OEM to an ODM. We develop a dynamic game to study how design outsourcing may impact product differentiation and downstream competition among OEMs.

■ TB53

H-Room 305, Third Floor

Integer Programming and Computational Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Yongpei Guan, Assistant Professor, Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - Linear and Mixed-Integer Models for Continuous Piecewise Linear Fitting
Alejandro Toriello, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, atoriello@gatech.edu, George Nemhauser, Juan Pablo Vielma

We propose linear and mixed-integer optimization models for the problem of fitting a continuous piecewise linear function to a finite set of data points. The models we study range from the separable case over a fixed grid to the non-separable convex case over variable regions introduced by Magnani and Boyd. We also study the additional constraints required to impose convexity on the best-fit function.

2 - Using Infeasible Nodes to Select Branching Variables
Emilie Danna, IBM, 1195 W Fremont Avenue, Sunnyvale, CA, 94087, United States of America, edanna@us.ibm.com, Andrea Lodi

In mixed integer programming, the choice of the branching variable is traditionally based on the history of changes in objective value caused by branching. This pseudocost strategy does not take into account branching decisions that create an infeasible child node. In this presentation, we describe how to integrate infeasible nodes into the branching variable selection. We discuss several alternatives and we show with computational experiments that our approach improves on the state of the art.

3 - Robust Unit Commitment Problem
Muhong Zhang, Asst Professor, Arizona State University, Arizona State University, Department of Industrial Engineering, Tempe, 85287, United States of America, Muhong.Zhang@asu.edu, Yongpei Guan

As energy market transforms from a regulated market to a deregulated one, the demands for the power plants are highly uncertain. In this talk, we study a two-stage robust optimization model of the unit commitment problem and provide a tractable solution approach for the problem. The computational experiments show the effectiveness of our approach.

4 - On Equivalence of Some Scale-reduction Techniques for the Maximum Weight Independent Set Problem
Sergiy Butenko, Associate Professor, Texas A & M University, College of Engineering, College Station, TX, 77843, United States of America, butenko@tamu.edu, Jianer Chen, Svyatoslav Trukhanov

We compare four different approaches used to reduce the size of an instance of the maximum independent set problem that have been proposed in the literature. We show that, even though each of the techniques were motivated by seemingly very different ideas, they are all equivalent in the sense that the reduced graph output by one of the algorithms cannot be further reduced by any other of the four methods.

■ TB54

H-Room 306A, Third Floor

New Perspectives on Machine Learning

Sponsor: Optimization/Networks
Sponsored Session

Chair: Nina Balcan, Microsoft, mabalcan@microsoft.com

1 - Machine Learning for Mechanism Design and Pricing Problems
Avrim Blum, Professor, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, avrim@cs.cmu.edu

A key problem in electronic commerce is the development of auction mechanisms for selling large quantities of items to buyers with complex preferences and needs. In this work we show how methods from machine learning can be used to produce simple approaches for achieving high revenue for a wide variety of such mechanism design problems. From a learning perspective, these settings present a number of challenges including a loss function that is discontinuous, asymmetric, and has a large range.

2 - Hierarchical Sampling for Active Learning
Sanjoy Dasgupta, University of California, San Diego, 9500 Gilman Drive #0404, La Jolla, CA, 92093, United States of America, dasgupta@cs.ucsd.edu

Active learning is a classifier learning scenario where all data points initially have their labels hidden. Any label can be revealed at a price, and the goal is to learn a good classifier while paying as little as possible. I'll present a scheme for active learning that is able to exploit cluster structure in data.

3 - Activized Learning: Transforming Passive to Active with Improved Label Complexity
Steve Hanneke, Carnegie Mellon University, Department of Statistics, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, shanneke@cs.cmu.edu

In active learning, a learning algorithm is given access to unlabeled examples, and can sequentially select examples to get labels for. In this talk, I will explain how to use any passive learning algorithm as a subroutine to construct an active learning algorithm that provably achieves an asymptotically superior label complexity.

4 - The Price of Uncertainty
Maria Florina Balcan, Assistant Professor, Georgia Institute of Technology, School of Computer Science, Atlanta, GA, 30332, ninamf@cc.gatech.edu

We study the degree to which small fluctuations in costs in well-studied potential games can impact the result of natural best-response and improved-response dynamics. We show that in certain cases, even extremely small fluctuations can cause these dynamics to spin out of control and move to states of much higher social cost, whereas in other cases these dynamics are much more stable even to large degrees of fluctuation.

■ TB55

H-Room 306B, Third Floor

Generalized Assignment Problems

Contributed Session

Chair: Robert Nauss, Professor, University of Missouri-St. Louis, 1 University Blvd., 209 CCB, St. Louis, MO, 63121, United States of America, robert_nauss@umsl.edu

1 - An Integer Programming Formulation for an Optimal Student Class Assignment Problem
Anand Seshadri, Dr., Booz Allen Hamilton, 8283 Greensboro Drive, McLean, VA, 22102, United States of America, seshadri_anand@bah.com, John Foreman, Nicholas Nahas, Cenk Tunasar

An integer programming formulation with a simultaneous equation postprocessor has been developed to optimally allocate student schedules in a training program. The objective of the optimization is to minimize the total number of students for each month. The formulation is efficient enough to implement in a stand-alone computer using Microsoft Excel in order to comply with client requirements. The postprocessor utilizes the output of the integer program to derive the final assignment of students.

2 - Random Combinatorial Problems on Hypergraph Matchings: Limiting Optimal Values and Convergence Rates

Pavlo Krokhmal, Assistant Professor, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, krokhmal@engineering.uiowa.edu

We consider random combinatorial optimization problems on hypergraph matchings, such as multidimensional assignment problems (Linear MAP, Bottleneck MAP, etc.), whose assignment costs are iid random variables. Convergence of the optimal values of such problems as functions of the problem dimensions is investigated. For a broad class of distributions of the assignment costs, we demonstrate convergence in L1 and almost surely, establish the convergence limits and corresponding convergence rates.

3 - A Class of Generalized Assignment Problems with Flexible Demand and Shared Resource Consumption

Chase Rainwater, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, chaserainwater@gmail.com, Joseph Geunes, Edwin Romeijn

We study a class of assignment problems that is applicable to various planning scenarios. In this problem class each job belongs to one of several job types. A fixed amount of capacity is consumed if any one of the jobs from a particular type is assigned to a given resource. In addition, the demand requirements associated with each job contain a form of flexibility. We propose and exact solution methodology for this class of problems and provide computational results.

4 - Repetitive Job Assignment Problem

Kursad Derinkuyu, The University of Texas at Austin, Operations Research / Industrial Eng, 1 University Station C2200, Austin, TX, 78712, United States of America, kursad@mail.utexas.edu, Anant Balakrishnan

We study a field service problem for a single resource and a given sequence of jobs. Each job requires multiple service operations to be performed periodically, and each operation has a time-varying completion cost that depends on the previous service time. We show that the problem is NP-Hard, describe an efficient algorithm for a special case, embed this method in a heuristic for the general problem, and discuss successful computational results.

5 - The Single Source Capacitated Facility Location Problem

Robert Nauss, Professor, University of Missouri-St. Louis, 1 University Blvd., 209 CCB, St. Louis, MO, 63121, United States of America, robert_nauss@umsl.edu

We propose a solution technique to solve hard instances of the Single Source Capacitated Facility Location Problem that take CPLEX over 8 hours to solve. When all facility variables are fixed, the remaining problem of 0-1 variables is a generalized assignment problem. After invoking certain relaxation tightenings and a heuristic to generate a good feasible solution, we generate a list of GAP problems that must be solved in order to ensure that an optimal solution to the SSCFLP is found.

■ TB56

H-Room 307, Third Floor

Advances in Nonlinear Programming Algorithms

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

1 - Modern First-Order Augmented Lagrangian Methods for Nonlinear Programming

Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu, Paulo J.S. Silva

We study augmented Lagrangian algorithms on the CUTEr nonlinear optimization test set, solving subproblems by Hager and Zhang's ASA box-constrained conjugate gradient method. We compare (1) the classic quadratic penalty versus log-quadratic and similar kernels, (2) dual versus primal-dual regularization, and (3) exact solution versus relative error subproblem termination. The results are somewhat different than we expected based on our earlier work on complementarity problems.

2 - An Interior-point Algorithm with Inexact Step Compuations

Frank Curtis, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America fecurt@gmail.com, Andreas Wächter, Olaf Schenk

We present an interior-point algorithm for nonlinear programming. The novelty of the method is that inexact solutions of the primal-dual equations are allowed during each iteration so that the method is efficient for large-scale applications, yet global convergence guarantees are still provided. Thus, the method presents a viable framework for large general-purpose problems, as we indicate with numerical results for PDE-constrained applications.

3 - Interior-Point Methods for NLP: Convergence Analysis and Computational Performance

Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu, Arun Sen, David Shanno

We present global and local convergence results for an interior-point method for NLP and analyze the computational performance of its implementation. The algorithm uses a penalty approach to relax constraints, provide regularization, and bound the Lagrange multipliers. Numerical testing on a set of NLPs, including degenerate and infeasible problems, confirm the theoretical results. We analyze the effects of enforcing theoretical convergence on the computational performance of the algorithm.

4 - On the Estimation of Behavioral Dynamics

Fabian Bastin, Assistant Professor, Université de Montréal, Dpt of Computing Science and Oper. Res., CP 6128, Succ Centre-Ville, Montreal, H3C 3J7, Canada, bastin@iro.umontreal.ca, Renting Xu, Cinzia Cirillo

Behavioral models are a key component of many studies related to marketing, transportation,... They are however mainly static, ignoring the sequence of individual choices. We consider here the process leading individuals to make specific purchase choices over time, and focus on the associated estimation problem. This is a basic maximum likelihood, where each individual choice however requires to solve a regenerative optimal stopping problem.

■ TB57

H-Room 308, Third Floor

Assessing Hospital Operations

Sponsor: Health Applications
Sponsored Session

Chair: Anita Vila-Parrish, North Carolina State University, 2248 Cranford Road, Durham, NC, 27705, United States of America, anita.vilaparrish@gmail.com

1 - Allocating Fixed Costs via Planning Models with Clearing Functions

Ali Kefeli, North Carolina State University, 2717 Brigadoon Drive, Raleigh, NC, 27606, United States of America akefeli@ncsu.edu, Reha Uzsoy

Although body of literature on cost accounting is extensive, research that has focused on mathematical programming models are of particular interest since they are derived from a rational model of maximizing a particular objective for the firm. In this paper we incorporate nonlinear congestion effects into these mathematical programming models and show the advantage of improved dual prices provided by those enhanced planning models, for cost allocation schemes proposed in the literature.

2 - Application of Perishable Inventory Models to a Hospital's Medication Supply Chain

Anita Vila-Parrish, North Carolina State University, 2248 Cranford Road, Durham, NC, 27705, United States of America anita.vilaparrish@gmail.com, Julie Ivy, Russell E. King

Pharmaceutical inventory management presents many challenges to practitioners because of uncertainty in demand and short shelf lives of the medications. In this research we formulate a perishable inventory model which has many applications to the hospital pharmaceutical supply chain.

3 - Managing Outpatient Appointments via Choose-and-Book

Houyuan Jiang, Cambridge University, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, h.jiang@jbs.cam.ac.uk, Sergei Savin, Zhan Pang

Choose and Book is a national electronic referral system for outpatient appointments in England. Choose and Book is instrumental in helping to measure and manage the 18-weeks pathways. We propose a dynamic control model to help the service provider to manage appointment time slots. We identify a simple and optimal threshold policy and conduct comparative statics analysis. Our analysis reveals the trade-off between the waiting time target and choice and explains what happens in practice.

■ TB58

H-Room 309, Third Floor

Modern Problems in Scheduling

Cluster: Scheduling
Invited Session

Chair: Marc Posner, Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, posner.1@osu.edu

1 - Appointment Scheduling and Applications
Mehmet Begen, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, mbegen@ivey.uwo.ca, Maurice Queyranne

We determine optimal appointment dates in polynomial time for a given sequence of jobs on a single processor to minimize the expected total underage and overage costs when jobs have random processing durations given by a joint discrete probability distribution. There are many important real-life applications for appointment scheduling, such as surgery scheduling, physician appointments, gate and runway scheduling of aircrafts in an airport.

2 - Rescheduling for Machine Disruption
Zhixin Liu, Assistant Professor, College of Business, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu, Young Ro

We consider scheduling problems where jobs have been scheduled when the machine becomes unavailable for a period of time. The disruption is measured by the maximum time deviation of any job from the original schedule. Our model minimizes a total cost objective subject to a limit on the disruption. For each of the four cost objectives considered, we provide a computationally efficient optimal algorithm, a fully polynomial time approximation scheme, and a general approximate solution procedure.

3 - Time-constrained Project Scheduling with Adjacent Resources
Johann Hurink, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, J.L.Hurink@utwente.nl, Leendert Kok, Jacob Jan Paulus, Marco Schutten

We develop a decomposition method for the Time-Constrained Project Scheduling Problem (TCPSP) with Adjacent Resources (AR). For AR, units are ordered and units assigned to jobs have to be adjacent. AR's are not required by single jobs, but by job groups. The AR-units are occupied from the start of the first up to the completion of the last job of the group. The developed decomposition method separates the AR assignment and the scheduling. Test results show the applicability of the method.

4 - A Unified Approach to the Measurement of Approximation Error
Nicholas Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall.33@osu.edu, Marc Posner

We develop a meta-theory to select measures to evaluate heuristic performance. The purpose and application define a set of requirements for a measure. Additional requirements are defined by the need for measure stability under various changes in data. Our methodology identifies conditions for the use of four possible error measures. It links application types, requirements for measurement metrics and for stability, and various error measures. We illustrate our methodology with case studies.

■ TB59

H-Room 310, Third Floor

Tutorial: Logistics and Transportation in Global Supply Chains - Review, Critique and Prospects

Cluster: Tutorials
Invited Session

Chair: James H Bookbinder, Professor, University of Waterloo, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, jbookbinder@uwaterloo.ca

Co-Chair: Tiffany A. Matuk, University of Waterloo, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, tamatuk@uwaterloo.ca

1 - Logistics and Transportation in Global Supply Chains - Review, Critique and Prospects
James H Bookbinder, Professor, University of Waterloo, Department of Management Sciences, Waterloo, ON, N2L 3G1, Canada, jbookbinder@uwaterloo.ca, Tiffany A. Matuk

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

■ TB60

H-Room 311, Third Floor

Applications of SDP to EDM and Other Polynomial Optimization Problems

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Henry Wolkowicz, University of Waterloo, Dept of Comb and Opt, Waterloo, ON, N2L 3G1, Canada, hwolkowi@uwaterloo.ca

1 - Universal Rigidity: Towards Accurate and Efficient Localization of Wireless Networks
Yinyu Ye, Professor, Stanford University, 316 Terman Engineering Building, Stanford, CA, 94305, United States of America, yinyu-ye@stanford.edu, Anthony Man-Cho So, Zhisu Zhu

We propose a notion of universal rigidity that captures a large class of wireless networks and is much more relevant to the efficient solvability of network localization problems. We give various constructions of universally rigid instances. We also apply our results to design a novel edge sparsification scheme that can reduce the size of the input network while provably preserving its original localization properties.

2 - Exploiting Sparsity in SDP Relaxation for Sensor Network Localization
Hayato Waki, Dr., The University of Electro-Communications, Chofugaoka, Chofu-Shi, Tokyo, 182-8585, Japan, hayato.waki@jsb.cs.uec.ac.jp, Masakazu Kojima, Sunyoung Kim

We present a sparse variant of the Biswas-Ye SDP relaxation for sensor network localization problems. We compare numerically the Biswas-Ye SDP relaxation, its sparse variant, and the edge-based SDP relaxation by Wang et al. to confirm the effectiveness of the proposed techniques for exploiting sparsity in SDP relaxation for sensor network localization problems. The sparse variant of the Biswas-Ye SDP relaxation outperforms all other SDP relaxations in speed.

3 - On SDP and ESDP Relaxations for Sensor Network Localization
Paul Tseng, Dept of Mathematics, University of Washington, Seattle, United States of America, tseng@math.washington.edu, Ting Kei Pong

We study SDP and ESDP relaxations for ad hoc wireless sensor network localization. In particular, we propose a noise-aware version whose solution set is more robust in the presence of noisy distance measurements. We also propose an efficient distributed method to find an interior solution.

4 - Explicit Sensor Network Localization Using Semidefinite Programming and Clique Reductions
Henry Wolkowicz, University of Waterloo, Dept of Comb and Opt, Waterloo, ON, N2L 3G1, Canada, hwolkowi@uwaterloo.ca, Nathan Krislock

The sensor network localization, SNL, problem consists of locating the positions of sensors, given only the distances between sensors that are within radio range and the positions of some fixed sensors (called anchors). By finding explicit representations of the faces of the SDP cone corresponding to unions of cliques of the SNL problem, we derive a preprocessing technique that solves the SNL problem, with exact data, by explicitly solving the corresponding SDP problem.

■ TB61

H-Room 312, Third Floor

Logistics

Contributed Session

Chair: Rafay Ishfaq, University of Alabama, 300 Alston Hall, Tuscaloosa, AL, United States of America, rishfaq@cba.ua.edu

1 - Design and Evaluation of Production Concepts for Modular Car Architectures
Marcel Helmdach, University of Paderborn, Deichsberg 9, Paderborn, 33106, Germany, marcel.helmdach@hni.uni-paderborn.de

Fords Model T was offered in just one standard type, but since then, the diversity of variants which car manufacturers offer has increased tremendously, resulting in high complexity costs for production and logistics. One possibility to handle this complexity and cut costs is modularization, meaning the outsourcing of a part of the production process from the main assembly line to sub assembly lines or suppliers. This presentation shows how OR can be used to find and evaluate suitable modules.

2 - Benefits and Challenges of GIS/GPS Application in Emerging Markets
B Zhou, CBPA, Kean University, 1000 Morris Ave, Union, NJ, 07083, United States of America, bzhou@kean.edu, H Zhong

We study the application of GPS/GIS technologies in logistic operations in emerging markets. As part of a bigger project, the study reveals some interesting preliminary results and demonstrates major benefits as well as limitations and challenges in the implementation process.

3 - Convex Bernstein Polynomial Approximation on the Stochastic Resource Allocation Problem
Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr., Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

We propose to solve large scale network resource allocation problem with stochastic demands by fitting the expected objective by a sequence of convex polynomials with non-negative coefficients and thereafter apply Newton's method on it. We apply a Weierstrass-like theorem and showed that if we can evaluate the expected appraisal function, we will reach the arbitrary optimal by solving the new problem. When experimental errors exist, we have the probabilistic convergence instead.

4 - Logistics Issues in Intermodal Hub Networks
Rafay Ishfaq, University of Alabama, 300 Alston Hall, Tuscaloosa, AL, United States of America, rishfaq@cba.ua.edu, Charles Sox

This research highlights the role of intermodal logistics within the modern supply chains. Modeling non-linear transportation costs, fixed location costs, modal connectivity costs and service time requirements, an intermodal (road, rail and air) logistics hub network is designed. In light of discussions with industry professionals and using real world data, this research develops managerial insights into the operational, financial and service performance of intermodal logistic networks.

■ TB62

H-Room 313, Third Floor

Behavioral Research in New Product Development

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Enno Siemsen, Assistant Professor, University of Minnesota, 1209 S. Sixth Street, Minneapolis, MN, 55405, United States of America, siems017@umn.edu

1 - Decentralized Balancing of Complementary Tasks
Enno Siemsen, Assistant Professor, University of Minnesota, 1209 S. Sixth Street, Minneapolis, MN, 55405, United States of America, siems017@umn.edu

In a centralized process, much is known how to balance the workload among different workstations. Less is known about how to balance the effort of team members working on complementary tasks in a decentralized ëwhite collar' environment. We therefore explore different mechanisms of how to achieve balance in the team and find that there is a trade-off between designing effective (i.e. productivity enhancing) and fair incentives.

2 - Diverse Preferences as a Source of Systematic Project Evaluation Biases
Nektarios Oraiopoulos, Judge Business School, University of Cambridge, Trumpington Street, Cambridge, United Kingdom, n.oraiopoulos@jbs.cam.ac.uk, Stylianos Kavadias

New Product development teams are often prone to two types of errors: terminating too early a project that would have been successful or continuing a project that eventually fails. Our work studies how the corresponding probability for each type of error changes as the NPD team becomes more diverse. The latter is captured by the dispersion that team members exhibit with respect to either their prior project evaluations or to their interpretive biases of new information.

3 - Complexity, Screening and Allocation Bias in R&D Pipelines
Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu, Paulo Figueiredo, Paulo Goncalves

We explore tradeoffs associated with key R&D pipeline management decisions in the presence of an allocation bias: either adding to the number of starts or selecting more complex projects and screening out a fraction of projects midway through the pipeline. We derive analytical conditions on the stability of the portfolio performance and use these conditions to compare alternative incentive schemes. We conclude by illustrating how these conditions can be tested experimentally.

4 - Antecedents and Consequences of Client-vendor Conflict in Distributed Project Organizations
Anant Mishra, University of Minnesota, Carlson School of Management, 321-19th Avenue S, Minneapolis, United States of America, mish0049@umn.edu, Kingshuk Sinha

As technology projects become increasingly distributed within and between firm and country boundaries, managing conflict between a client and the vendor in such projects has become critical to their effective execution. Using primary data from 830 technology projects, we examine the antecedents and consequences of client-vendor conflict (relationship conflict and task conflict) across four types of project organization (Insourcing, Outsourcing, Offshoring, and Offshore-Outsourcing).

■ TB63

H-Room 314, Third Floor

Modeling and Optimization in Health Care

Contributed Session

Chair: Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu

1 - A System Approach for Uncertainty Modeling in Clinical Laboratory Measurements
Varun Ramamohan, Graduate Student (PhD), Department of Industrial Engineering, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States of America, vramamoh@purdue.edu, Vishal Chandrasekar, George Klee, Jim Abbott, Yuehwern Yih

Systematic errors in laboratory measurements have significant impact on clinical decisions, patient safety and medical costs. A system approach towards quality control of clinical laboratory measurements is described in this paper. We present a calibration model that identifies the sources of systematic error and then systematically analyzes the propagation of these errors throughout the process. Monte Carlo simulation is used to derive the general uncertainty measure for this bias.

2 - Modeling the Treatment-prevention Tradeoff
George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org, Matt Daly

It is frequently claimed "with little quantitative evidence" that current health care expenditures inappropriately emphasize treatment over prevention. We are investigating this assertion using a dynamic model of the impacts of alternative investments in treatment and prevention, and in research to develop new treatment and prevention interventions, on effectiveness (measured in quality adjusted life years). We describe the structure of the model and emerging results from its application.

3 - Radiation Quality Assurance with DICOM Information
Shanshan Wang, PhD Student, Arizona State University, School of CIDSE, Tempe, AZ, 85281, wshanshan@asu.edu, Teresa Wu, Muhong Zhang, Mary B. Peter, Richard L. Morin, Steve Langer, Catherine C. Roberts, William Pavlicek, Beth A. Schueler

The oversight and monitoring of radiation dose use are required in federal and state statutes. Digital Imaging and Communications in Medicine (DICOM) standards is a widely adopted standard in radiation imaging processing. In this study, we build an information system to capture the information in DICOM compliant radiation images and explore their use in routine quality assurance activities. The system consists of a knowledge base of known devices (i.e. modalities), a patient episode dose tracking database and a set of web-based reporting tools. The implementation potentially provides quantitative data hints to reduce radiation exposure and automates the radiation regulatory compliance process.

4 - The When Diet: Mathematically Optimizing Eating and Exercise for Weight Loss
Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, teaston@ksu.edu

Over the past five years I have studied the dieting problem and recently published The When Diet: Mathematically Optimizing Eating and Exercise for Weight Loss. This talk presents the major developments contained in this book, including a mathematical proof of The When Diet, the stochastic properties of hunger, lean manufacturing and how to minimize the misery incurred by being on a diet while maximizing the amount of weight lost.

■ TB64

H-Room 202A, Second Floor

Business Analytics in the Business School

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Curt Hinrichs, Manager, JMP Academic Programs, SAS Institute, One Montgomery Street, 34th floor, San Francisco, CA, 94104, United States of America, Curt.Hinrichs@sas.com

Co-Chair: Jerry Oglesby, SAS, Jerry.Oglesby@sas.com

1 - Bringing MBA Students and Practitioners Together Through Analytics

Russell Walker, Northwestern University, Kellogg School of Management, Evanston, IL, United States of America, russell-walker@kellogg.northwestern.edu

Over the last few years, we have seen a strong interest by recruiters in MBA talent that possesses not only strong business skills, but advanced quantitative skills. The classic MBA curriculum provides core courses in statistics and decision making, and with select electives, many students develop advanced quantitative skills. At the Kellogg School of Management, experiential learning is a pillar of the learning process. This talk describes the formulation of the Analytical Consulting Lab, an experiential course that brings together MBA students with companies on real-world problems, where the focus is on analytics.

2 - Teaching Data Warehousing, Business Intelligence, Data Mining From Business Strategy Point of View

Arif Ansari, Assistant Professor of Clinical in IOM, University f Southern California, Marshall Schol of Business, 3670 Trousdale Parkway, BRI 401, Los Angeles, CA, 90087, United States of America, aansari@usc.edu

In this paper, we will show teaching business strategy first and then discussing the three different tools is better. We will discuss the current strategies in business today and show it can be enabled by the combination of all the three topics. The paper will discuss how the understanding of the business strategies enable the students to capture key variables in the business processes, design better Warehouses, build better Business Intelligence tools and develop appropriate data mining models.

3 - Business Plus Intelligence Plus Technology Equals Business Intelligence

Ron Klimberg, Professor, Saint Joseph's University, 5600 City Avenue, Philadelphia, PA, 19131, United States of America, klimberg@sju.edu, Ira Yermish, Virginia Miori, John Yi, Rashmi Malhotra

Over the last decade or so, a seemingly new discipline called business intelligence has emerged. While there are several professional/consulting organizations few universities have adapted their research, academic programs and their organizational structures to adapt to this change. We will argue that we are seeing a fundamental change in the organizational approach to the disciplines that have fed into contemporary business intelligence and resulting in a change in our academic programs.

4 - Data Mining with JMP

Tom Bohannon, Higher Education Consultant, SAS Global Academic Program, SAS Campus Drive, Cary, NC, 27513, United States of America, tom.bohannon@sas.com

Data mining can be defined as advanced methods for exploring and modeling relationships in large amounts of data. The emphasis will be on data mining for predictive modeling with a binary target. These concepts and data mining tasks will be illustrated using JMP, a SAS product. A large part of the presentation will be on using JMP's partition platform (decision tree) partition platform enables users to systematically analyze large data sets to discover unsuspected or unknown relationships.

■ TB65

H-Room 202B, Second Floor

WORMS Keynote Session

Sponsor: Women in OR/MS
Sponsored Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, Terman Enineering Center, Room 305, Stanford, CA, 94305, United States of America, ferhun@stanford.edu

1 - From Venn Diagrams to Public Health Policy: An OR Journey

Margaret Brandeau, Professor, Stanford University, 407 Terman Engineering Center, MS&E Department, Stanford, CA, 94305, United States of America, brandeau@stanford.edu

How can you carve out a successful career in OR? Can you have it all? Do you even want to have it all? How is the OR/MS profession evolving? In this talk I will describe my OR journey, from undergraduate math major to professor of management science and engineering. I will reflect upon my research career and personal experiences along the way.

■ TB66

H-Room 204A, Second Floor

Real Options in Operations Management

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu

1 - Exploring and Exploiting the Value of Clicks in Operations Management

Tingliang Huang, Ph.D. Candidate, Kellogg School of Management, Northwestern University, Leverone 529, Jacobs Center, 2001 Sheridan Road, IL 60208, Evanston, IL, 60208, United States of America, tingliang-huang@kellogg.northwestern.edu, Jan Van Mieghem

Recent Internet clicks-tracking technology allows firms to know who is visiting their website and gather visitors' online click behavior. First, using clicks and actual sales data, we provide empirical evidence that clickstream data can be used as imperfect advance demand information (ADI) to predict future demand in an offline transaction setting. Second, assuming a firm can use clicks as ADI, we study whether strategic/myopic consumers have an incentive to visit the website.

2 - Incentive Outsourcing Contracts for Technology Adoption: A Principal Agent Perspective

Baichun Feng, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, buf118@psu.edu, Tao Yao, Bin Jiang

In this study, we analyze how the client can promote the vendor to adopt a new green technology via an incentive outsourcing contract. Such contract is based on investment timing where agency conflicts and information asymmetries occur. Incentives are provided by the client to the vendor to incur costly effort and truthfully disclose private information. We show how to derive the optimal outsourcing contract and the effect of agency issues.

3 - Outsourcing Contract Selection and Timing Decision

Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Susan Xu, Yongma Moon, Bin Jiang

This talk discusses how a pre-outsourcing firm facing uncertain operating costs selects the outsourcing contract and decides the outsourcing timing. We develop a real options model to investigate this firm's choice between a fixed-price contract and a cost-plus contract. Our results may help managers gain a better understanding of the closely intertwined relationship between the contract type and contract timing, so that make appropriate outsourcing decisions.

■ TB67

H-Room 204B, Second Floor

DEA in Banking and Investment

Cluster: Data Envelopment Analysis
Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu

1 - A Mean-variance Efficiency Approach to Efficient Resource Allocations

Chien-Ming Chen, Postdoctoral scholar, Center for Corporate Environmental Performance, UCLA Institute of the Environment, La Kretz Hall, Suite 300, Box 951496, Los Angeles, United States of America, cmchen@ioe.ucla.edu, Joe Zhu

This paper proposes an intergraded approach to single-stage resource allocations, in which we consider the mean-variance trade-off of productive efficiency among allocation portfolios. In this paper, we develop a new efficiency index and its bootstrap algorithm, whose outputs are used to estimate parameters in the allocation model. To illustrate we apply our approach to an empirical R&D project budgeting problem. This paper presents a novel application of the efficiency bootstrap method.

2 - Profit Efficiency and Return on Equity in Banking: Evidence From Indian Data

Kankana Mukherjee, Assistant Professor, Babson College, Economics Division, 231 Forest Street, Babson Park, MA, 02457, United States of America, kmukherjee@babson.edu, Subhash Ray, Abhiman Das

In this paper we provide a decomposition of return on equity (ROE) that examines the role of profit efficiency as one of its several components. Our decomposition also captures the role of risk and solvency, among other factors, in determining the ROE. We use Data Envelopment Analysis (DEA) to measure profit efficiency and apply the proposed decomposition using data from individual Indian banks of different ownership categories for the period 1997-2003.

3 - Sustainability Assessment of Venture Business Firms

Chang Won Lee, Operations and Service Management, School of Business, Hanyang University, Seoul, 133-791, Korea, Republic of, leecw@hanyang.ac.kr, N. K. Kwak

An appropriate assessment of sustainability in venture business is an important managerial and investment decision making. Data envelopment analysis is utilized for sustainability assessment for venture business firms' performance. Required information for this study is collected from Korea Listed Companies Association database. The proposed model provides decision-makers with more accurate information for strategic insights in order to make better investment decisions.

■ TB68

H-Room 206, Second Floor

OR Practice in INFORMS Roundtable Companies

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Arnold Greenland, Distinguished Engineer, IBM, 6710 Rockledge Drive, Bethesda, MD, 20817, United States of America, agreenland@us.ibm.com

1 - Optimization Applications at SAS Institute

Manoj Chari, Director, Operations Research R&D, SAS Institute, 100 SAS Campus Drive, Cary, United States of America, Manoj.Chari@sas.com

Operations Research has been a key area of R&D investment as SAS Institute has embarked on a long term strategy to expand its portfolio of offerings to include problem-specific business applications and industry solutions. This talk will highlight a few instances of such applications and solutions in which optimization plays a crucial role.

2 - Improving Operations at GE

Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

Over the past 15 years General Electric (GE) Global Research Center has developed a number of optimization algorithms and decision support systems that are currently in use across GE. In this talk, I will present a brief overview of some of this work.

3 - The Practice of OR/MS inside Intel Corporation

Karl Kempf, Intel Corporation, 5000 W. Chandler Blvd., MS-CH3-10, Chandler, AZ, 85226, United States of America, karl.g.kempf@intel.com

The Decision Engineering Group at Intel has been active for 22 years and has developed decision support tools for most divisions of the company using many different OR/MS techniques to solve a wide spectrum of business problems. We have learned valuable lessons, usually the hard way. This talk is about what you need to know to successfully develop and deploy successful OR/MS application in addition to the math.

■ TB69

H-Indigo A, Second Floor

Single Machine Scheduling

Contributed Session

Chair: Stefan Bock, Professor, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42097, Germany, sbock@winfor.de

1 - The Comparison of Permutation Genetic Algorithm Crossover Operators

Zuhal Kartal, Research Assistant, Anadolu University, Industrial Engineering Department, Eskisehir, Turkey, zkartal@anadolu.edu.tr, Gokhan Kirlik

The single machine total weighted tardiness problem with sequence dependent setup times is a challenging and heavily studied problem. In literature, different solution methods are used to solve this problem. One of them is genetic algorithm (GA) which has lots of operators. The most important operator of GA is crossover operator. This operator affects the solution quality. In this study, the performance of permutation type crossover operators is compared for this problem with benchmark problems.

2 - An Evolutionary Algorithm for Machine Scheduling Subject to Inventory Constraints

Dirk Briskorn, Christian-Albrechts-Universitaet, Olshausenstr. 40, Kiel, 24098, Germany, briskorn@bwl.uni-kiel.de

We consider inventory constraints in a single machine environment. Here, jobs add and remove items to an inventory and from an inventory, respectively. Jobs removing items cannot be processed if the required amount of items is not available. We consider problems on a single machine with the objective functions common in machine scheduling and develop a GA framework to solve them. We outline concept of the algorithm as well as computational results.

3 - Minimizing Sequence-dependent Setup Costs under Due Date Restrictions

Stefan Bock, Professor, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42097, Germany, sbock@winfor.de, Kathrin Klamroth

In this paper the minimization of sequence-dependent setup costs under due date restrictions is addressed. Analogously to the approach of Gilmore and Gomory, setup costs are assumed to be proportional to absolute state differences. We show that the integration of due dates leads to a strongly polynomial problem if the number of setup states is a constant. By making use of new dominance rules, problem instances of larger size can be solved optimally by a best-first Branch&Bound procedure.

■ TB75

C-Room 32A, Upper Level

Railroad Capacity Planning Session II

Sponsor: Railroad Applications
Sponsored Session

Chair: Clark Cheng, Sr. Manager Operations Research, Norfolk Southern Corp., 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, Clark.Cheng@nscorp.com

1 - Evaluating the Impact of Advanced Railway Technologies on Line and Network Capacity

Yung-Cheng Lai, Assistant Professor, National Taiwan Universtiy, Rm 313, Civil Engineering Bldg, No 1, Roosevelt Rd, Sec 4, Taipei, 10617, Taiwan - ROC, yclai@ntu.edu.tw, Mark Dingler, Christopher P.L Barkan, Sofi Chiang

In this research, we aim to identify advanced operating technologies, such as PTC and ECP brakes, with the potential to positively affect network capacity, and then develop analytical tools and conduct analyses to quantify the capacity benefits of various possible scenarios. This will provide railroads with a method to evaluate and quantify the potential benefits and help them determine the most cost effective plan for adopting these new technologies to meet future demand.

2 - Investigating the Impact of Train Type Heterogeneity on Railroad Capacity Using Simulation Modeling

Mark Dingler, Graduate Research Assistant, University of Illinois at Urbana-Champaign, B118, Newmark Lab., 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, dingler2@illinois.edu, Yung-Cheng Lai, Christopher P.L Barkan

Efficient planning of new railroad capacity requires understanding how operational practices affect capacity and heterogeneity in train and traffic characteristics is a key aspect of railway operations. Train dispatching simulation software was used to analyze the effect of heterogeneity in train speed, power to ton ratio and priority on traffic delay and the effectiveness of certain operating strategies that may reduce these delays.

3 - Railway Dispatching with Perfect Delay Information

Steven Harrod, Assistant Professor, University of Dayton, 300 College Park, Dayton, OH, 45469, United States of America, steven.harrod@udayton.edu

An optimal schedule is derived for a mixed traffic railway network using a discrete time multicommodity flow model. Solutions are generated without delays, and with advance information of delays. The impact of the stochastic delays on system utility and dispatch strategy is discussed.

4 - Integrating Steady State and Dynamic Rolling Stock Models with Cyclical Demand

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

Transportation companies position rolling stock (e.g., containers, locomotives) where it will be needed in the face of weekly cyclical demand pattern. Locations have target levels for rolling stock supply based on strategic, steady state models. In a stochastic tactical setting, deviations from the strategic steady state targets are common. We look at optimal recovery paths to the steady state target levels and the integration of steady state and dynamic models.

Interactive Session

Tuesday, 12:30pm - 1:30pm

Exhibit Hall

1 - A Case Study for Analysis of the Cost Change in Construction Risk Management

Omer Faruk Baykoc, Gazi University, Maltepe, Ankara, 06570, Turkey, baykoc@gazi.edu.tr, Veysel Sinan Yuzbasi

This study aimed at comparing the possible effects of the demand changes which can be executed in abode construction projects on the project planning. The risk related with the workload increase of the demand changes in abode construction projects to different neighborhoods was examined via PERT and analyzed via cash flow method. To this end, the risk of earlier completion of two different projects was analyzed, the cash flows of revenues and expenses were compared and interpreted by NPV method.

2 - A Framework for Estimation of Configurable Product Substitution Rates: Application to Auto Markets

Dingzhou Cao, GRA, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, dcao@wayne.edu, Ratna Babu Chinnam, Alper Murat

High product substitution rates and product configurability in automotive market presents inventory management challenges. We propose a framework for estimating vehicle substitutions based on 'option' differences and apply it to automotive market. The model is based on maximum likelihood approach and employs a Markov Blanket scheme to manage model complexity.

3 - A Hybrid Meta-heuristic Approach to Design of Reliable Networks

Fulya Altiparmak, Professor Dr., Gazi University, Faculty of Engineering and Architecture, Maltepe, Ankara, 06570, Turkey, fulyaal@gazi.edu.tr, Berna Dengiz, Onder Belgin

This study presents a hybrid meta-heuristic approach based on particle swarm optimization (PSO) and simulated annealing (SA), PSO_SA, to design of communication networks with minimum cost under all-terminal reliability constraint. In order to investigate the effectiveness of the PSO_SA, comparisons with other heuristic approaches, which are proposed for the design problem, are carried out. Computational results show that PSO_SA is an effective heuristic approach to design of reliable networks.

4 - A Manufacturing and Remanufacturing Aggregate Planning Model with a Non-linear Supply Function

Jordi Olivella, Associate Professor, Technical University of Catalonia, Edifici C3. Despatx 101, C. Esteve Terradas, 5, Castelledefels, 08860, Spain, jorge.olivella@upc.edu, Amaia Lusa, Albert Corominas

A mathematical programming model is proposed for aggregate planning considering manufacturing of new units and remanufacturing of used ones with indistinguishable final products. The recovered units may have different used conditions. A non linear relation between the price offered to the customers for the used units ant the proportion of used units that are recovered is considered. The optimal price at each planning period is determined by the model.

5 - A Proposed Knowledge Sharing Platform

Albert Cruz, Instructor, National University, 3678 Aero Court, San Diego, CA, 92123, United States of America, acruz@nu.edu, Jonathan Ng

The proposed platform utilizes a hybrid of EMS (electrical meeting system) and social networking to overcome the fundamental barriers of knowledge sharing. Various existing knowledge sharing environments are examined and evaluated in terms of (a) quality, (b) ratio of content contributors to passive members, and (c) ease of future retrieval.

6 - BioDE: A Novel Differential Evolution Approach for Molecular Conformational Search

Athina Brintaki, PhD Candidate, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, 33620, United States of America, abrintak@mail.usf.edu

This research poster proposes a new scheme called Biological Differential Evolution (BioDE) to minimize the molecular energy based on a differential evolution algorithm and our previously developed data structure called geBGF. The proposed BioDE utilizes the geBGF approach as a surrogate approximation model to reduce the number of exact evaluations and hence, to speed molecular conformational search and to reduce the algorithm's convergence rate.

7 - HOPSPACK Software Framework for Parallel Derivative-free Optimization

Todd Plantenga, PMTS, Sandia National Laboratories, 7011 East Ave, Livermore, CA, 94550, United States of America, tplante@sandia.gov

HOPSPACK (Hybrid Optimization Parallel Search PACKage) solves derivative-free optimization problems using an open source C++ framework. The framework enables parallel operation using MPI and multithreading. Multiple algorithms can be hybridized to run simultaneously, sharing a cache of computed objective and constraint function evaluations that eliminates duplicate work. HOPSPACK comes with a Generating Set Search algorithm, and is easily extended by developers to add new algorithms.

8 - Large Problems and Small Problems

Mark Spearman, President, Factory Physics, Inc., 3600 E. 29th, Bryan, TX, 77802, United States of America, spearman@factoryphysics.com

We address the large problems facing manufacturing supply chains: what is the optimal capacity, inventory, service level to customers, lead times, and what should be made to order as opposed to stock? These "large" problems can be addressed by considering a single smaller but more difficult problem that is non-linear, integer, and not always convex. We present methods to address the problem and results from industry in an interactive session using web-based software.

9 - Large Scale Evacuation of Carless People: A Tabu Search Algorithm for Bus Routing Problem

Chi Pak Chan, PhD Student, ATLAS Center, University of Arizona, P.O. Box 210020, Tucson, AZ, 85721-0020, United States of America, cpchan@email.arizona.edu, Mark Hickman

We consider the large-scale evacuation of carless people under short- and long-notice disasters. Assuming the carless are congregated at evacuation sites in the affected area, and number of carless at each evacuation site is known. A Tabu Search algorithm has been developed to produce itineraries of buses to pick up the carless at the evacuation sites and deliver them at safe locations, with an objective to maximize the number of carless evacuated within the given time limit for evacuation.

10 - Model-based and Optimizing Design Methodology for Production Systems

Petri Eskelinen, University of Jyväskylä, P.O. Box 35 (Agora), University of Jyväskylä, FI-40014, Finland, petri.a.eskelinen@jyu.fi, Sauli Ruuska

We introduce a project where new model-based and optimizing design methodology for material and information flows in production systems is being developed. The overall aim is to increase flexibility in process design and reduce capital employed in production lines. The main application area is pulp and paper industry.

11 - On an Analysis of Scheduling for Virtual Manufacturing Cells: Batch Splitting

Zulal Gungor, Professor, Gazi University, Gazi Uni. Industrial Eng. Dept., Maltepe, Ankara, 06570, Turkey, zulalg@gazi.edu.tr, Saadettin Kesen

For scheduling Virtual Manufacturing Cells, We developed two Mixed Integer Programming formulations, one of which is with batch splitting. Makespan and total travelling distance are objectives. On a wide range of test problems, we run two models and results show that batch splitting provides better system results while increasing scheduling complexity.

12 - Optimizing Screening for Colorectal Cancer Prevention and Surveillance

Fatih Safa Erenay, University of Wisconsin Madison, 501 N Midvale Blvd Apt C, Madison, WI, 53705, United States of America, erenay@wisc.edu, Oguzhan Alagoz

Colorectal cancer (CRC) can be prevented or early-detected via CRC screenings. We develop a finite-horizon POMDP model in order to obtain the optimal colonoscopy screening policy for the objective of maximizing total expected quality-adjusted life-years. Ours is the first analytical model considering both CRC prevention and surveillance using clinical data.

13 - Planning Tools for Program Management in a Supply Chain Context

Suri Gurumurthi, PhD Candidate / Instructor, Duke University Fuqua School of Business, 1 Towerview Road, Box 90120, Durham, NC, 27708, United States of America, sg61@duke.edu

Programs are often are conceived, planned, and executed within a supply chain context. Defining and allocating program tasks or roles across the set of firms, and managing the program related objectives of a diverse collection of resource groups is therefore a central challenge for many supply chains. Using well known cases and examples, we highlight some evolving models, frameworks and tools to help supply chains manage and control their critical programs.

14 - The Potential of Multi-player Agent-based Simulations in the Modeling of Complex Service Systems
Natalie Simpson, Assoc. Professor, University at Buffalo (SUNY), 351 Jacobs Management Center, Buffalo, NY, 14052, United States of America, nsimpson@buffalo.edu, Philip Hancock

Agent-based modeling stresses the representation of systems as sets of distinct autonomous agents, behaving and interacting according to locally available information. Multi-player virtual reality environments allow the incorporation of authentic human agents into otherwise computational simulations, as demonstrated with the modeling of an existing emergency room in this pilot study.

15 - Observability and Sensor Placement for Advanced Power Systems
Adrian Lee, University of Illinois, 201 N. Goodwin Ave, Urbana, IL, 61801, United States of America, ajlee4@illinois.edu, Urmila Diwekar

Obtaining a network of optimal sensor locations for advanced power systems involves both maximizing cost effectiveness and minimizing environmental impacts. Preliminary work is presented in establishing an observability measure for nonlinear chemical processes under uncertainty, based on Fisher information, to simultaneously address the sensor placement and parameter identification problems.

16 - Modeling the Physician Preference Item Supply Chain
Cara Dienes, Iowa State University, 3038 Black Engr., Ames, IA, 50014, United States of America, cdienes@iastate.edu, John Jackman

Physician preference items are a key component of healthcare supply costs. This work models the device manufacturer, physician, and hospital roles in the physician preference item procurement process, in order to learn how the unique characteristics of this supply chain, such as a lack of price transparency and a high rate of technological change, may impact costs.

17 - Physiological Aspects of Load Encumbrance in an Agent Based Force-on-force Constructive Simulation
Mitha Andra, Technology Solutions Experts,Inc., 203 West Central Street, Natick, MA, 01760, United States of America, mitha.andra@gmail.com, Dan Rice

The research goal is a comparative assessment of the impact of systems/equipment/clothing on human task performance as represented in the Infantry Warrior Simulation (IWARS). We consider a variety of modeling challenges and physiological interactions. The initial implementation is a model predicting sustainable energy expenditure, subjected to equipment load, for movement related tasks. Future work will include other encumbrances (e.g. cognitive) on soldier task performance.

18 - AMHS Scheduling in Semiconductor Manufacturing
Emrah Zarifoglu, PhD Candidate, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, zarifemrah@gmail.com, John Hasenbein, Erhan Kutanoglu

Full automation of manufacturing operations in the semiconductor industry has brought new challenges to material handling in wafer fabrication. Scheduling AMHS in a wafer fab has become a significant factor in order to achieve cycle time reductions by synchronizing AMHS operations with production activities. We analyze current myopic AMHS decision making models and search possible benefits of known information on AMHS scheduling using analytical modeling and optimization.

19- Markovi - An Interactive Approach to Learning Markov Chain Analysis
Daniel Silva, OR Sr. Analyst, Kimberly Clark Corp., Cra. 11A # 94-25 P5, Bogota, Colombia, daniel.f.silvaizquierdo@kcc.com, German Riano

Markovi is a didactic spreadsheet application which allows students to easily visualize, simulate and solve discreet time Markov chains. The user inputs the transition matrix and initial conditions vector, Markovi constructs the transition diagram, reports steady state probabilities, absortion probabilities and allows step by step simulation of the Markov chain.

20 - Sum of Squares and Polynomial Convexity
Amir Ali Ahmadi, MIT, 195 Binney st., Apt. #4401, Cambridge, MA, 02142, United States of America, a_a_a@mit.edu

The algebraic notion of sos-convexity has recently been proposed as a sufficient condition for convexity of polynomials based on semidefinite programming. Motivated by its computational tractability, it has been speculated whether sos-convexity is also a necessary condition for convexity of polynomials. In this paper, we give a negative answer to this question by presenting an explicit example of a trivariate homogeneous polynomial of degree eight that is convex but not sos-convex.

21 - Research Agenda on Integrated Hospital Material Management
Vesa Kamarainen, TKK, Helsinki University of Technology, P.O. Box 9500, Espoo, Finland, vkama@cc.hut.fi, Antti Peltokorpi, Karita Reijonsaari, Ann-Marie Turtiainen

Healthcare material logistics is widely discussed in academic literature but only little attention is paid to integrated material management (IMM).Inventory management, deliveries to wards and ward logistics have been seen as separate activities inside hospital.It means increased costs, but has also impacts on care process due to the long waiting times and incorrect material deliveries. We present a research agenda on IMM based on our hospital pilot project data in Helsinki metropolitan area

22 - An Empirical Study on IT-enabled Supply Chain Value Co-creation
Yao Zhang, Georgia Institute of Technology, Graduate Living Center, 10th Street NW, Atlanta, United States of America, zhangyao@gatech.edu, Lih-Bin Oh, John Talbot

Enterprises across industries are adopting new IT systems to facilitate collaborative relationships with external partners to achieve supply chain-wide competitive advantages. Based on an empirical investigation of a global FMCG's new web-based multi-firm IT implementation in a developing country, this study expands the current trajectory of IT value research by examining IT-based value co-creation among multiple supply chain network parties.

23 - New Preference Models and Optimization Methods for Complex Decision Problems with Multiple Criteria
Alexander Engau, Assistant Professor, University of Colorado Denver, Mathematical and Statistical Sciences, Campus Box 170, PO Box 173364, Denver, CO, 80217-3364, United States of America, aengau@alumni.clemson.edu

To recover and foster economic and technological prosperity, decision-makers today can highly benefit from new advances that enhance the development of mathematical models, optimize the computation of candidate alternatives, and facilitate the choice of preferred efficient solutions. Summarizing our contributions to cone-based preference models and multicriteria optimization, we highlight their significance on applications in structural engineering, vehicle layout, and financial risk management.

24 - Translating Inventions into Products: Inventors' Educational Background and Speed of Licensing
Ayfer Ali, PhD Candidate, Harvard University/HBS, 44 HBS Mail Ctr, Boston, MA, 02163, United States of America, aali@hbs.edu

The increased amount of funding that goes into 'translational research' emphasizes the need for interdisciplinary and multidisciplinary research and the training of interdisciplinary researchers, specifically MD/PhDs. I use invention and patent data from three large Academic Medical Centers to understand whether the educational background of team of inventors influences licensing/translation of the inventions.

25 - Simulation and Optimization of Nurse-to-Patient Assignments
Durai Sundaramoorthi, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu, Jay Rosenberger, Victoria Chen, Prattana Punnakitikashem, Seoung Kim, Deborah Behan, Lance Wheeler

The health care system in the United States has a shortage of nurses. A careful planning of nurse resources is needed to ease the health care system from the burden of the nurse shortage and standardize nurse workload. This research presents simulation and optimization based policies to make nurse-to-patient assignments.

26 - Post Optimization in Mulitple Crew Scheduling Problems
Konrad Borys, Sabre, 3150 Sabre Drive, Southlake, TX, 76092, United States of America, konrad.borys@sabre.com, Shengli Qiu

We present how post optimization can improve a solution quality for crew pairing, rostering, crew recovery and staff rostering problems. We describe different strategies for selecting the subproblem and different methods of solving it. We also show computational results.

27 - Pattern-based Analysis of Supply Chain Collaboration - A Business Process Perspective
Zhe Shan, Penn State University, 419A Business Building, University Park, PA, 16802, United States of America, zheshan@psu.edu

How to analyze the correctness and robustness of business collaboration is essential for supply chain success. Prevailing IT technologies such as Web services lead to considerable automatic inner- or cross-organization interaction. Based on them, we propose a pattern compatibility matrix and rules that allow us to simplify the task of checking compatibility between two or more processes. Via this way we give executives a metric to evaluate the maturity of a business collaboration.

28 - A Stochastic Location Model for Hurricane Relief
Desiree Tejada-Calvo, Florida International University, 10555 West Flagler Street, Miami, FL, 33174, United States of America, dteja001@fiu.edu, Martha Centeno

Unlike earthquakes and terrorist attacks, a hurricane response plan can be activated ahead of time, since a hurricane is predicted at least five days before it makes landfall. In this study, a dynamic stochastic model to locate facilities

during the response phase of a hurricane disaster is presented. The novelty of the model is that it incorporates the strength and path of the hurricane as stochastic processes. These stochastic behaviors are modeled as Discrete Markov Chains.

29 - Process Standardization in Services Outsourcing: From Implementation to Performance Improvement
Bryon Balint, PhD Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Posner 315C, Pittsburgh, PA, 15215, United States of America, bbalint@andrew.cmu.edu

Services firms continue to seek innovations that lower costs or enhance delivery performance. This research includes three related empirical studies which evaluate the use of a process standardization framework in an offshore service delivery center. Study 1 focuses on process implementation, while studies 2 and 3 examine the resulting performance improvements.

30 - Emergency Shelter Location and Resource Allocation
Sara Ghorbani, PhD Student, Rutgers University, ISE Department, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, ghorbani@eden.rutgers.edu

Recent unexpected climatic events are testing our emergency response capabilities. In such an event, people can be moved to shelters with climate controlled environments and provisions for healthcare needs. We present a plan for evacuation with the objective of minimizing the adverse health effects of a weather related disaster. We introduce a stochastic program to solve the emergency-shelter location and allocation problem in which people are assigned to optimally located and equipped centers.

31 - An Approach to Renovation Task Sequencing with Multi-Criteria Objectives
Steven Yuhaski, Jr., Operations Research Analyst, Natick Research, Development, and Engineering Center, 1 Kansas St., Natick, MA, 01760, United States of America, steven.yuhaski@us.army.mil

Large sections at facilities undergoing extensive renovation often require personnel to move temporary shelters having limited capacity, prior proceeding to their final locations. A model of the flow of personnel to various locations, as a function of optimal task sequencing, via an efficient genetic programming heuristic, has been formulated.

32 - Addressing Sources of Uncertainty in Strategic Fire Planning
Matt Thompson, USDA Forest Service, Rocky Mountain Research Station, Missoula, MT, United States of America, matt.thompson@gmail.com, Dave Calkin

Strategic fire planning is subject to manifold sources of uncertainty. Beyond the unpredictability of wildfire behavior, uncertainty stems from inaccurate/missing data, poor scientific understanding of ecological response to fire, and relative prioritization of non-market resource values. This work attempts to systematically align sources of uncertainty with the most appropriate decision-support methodologies, in order to facilitate cost-effective, risk-based wildfire planning efforts.

33 - Credit Risk Portfolio Optimization
Oleksandr Romanko, PhD Candidate, McMaster University, 1280 Main Street West, Hamilton, ON, L8S4K1, Canada, romanko@mcmaster.ca, Tamas Terlaky, Helmut Mausser, Ian Iscoe, Alexandr Kreinin

We develop, evaluate and compare several optimization models that derive from a structural, or Merton-type, model for credit risk. In particular, we consider formulations that combine simulation with analytic approximations, when minimizing Value-at-Risk or expected shortfall of a credit-risky portfolio. Theoretical results and computational tests on large datasets are reported.

34 - Integrated Dispatching Problem in Container Terminals
Yuan Wang, PhD Candidate, National University of Singapore, BLK E1A05-21, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, wangyuan@nus.edu.sg

The objective of our study is to develop a scientific decision tool to systematically assist in managing various major operational processes within a real container terminal, such as quay crane, yard crane, and vehicle transportation activities. The tool is to address the integrated problem for transshipment hub which takes into consideration of the coordination among all the equipments. Simulation and optimization techniques will be deployed to integrate these activities.

35 - Supply Chain Optimization for the World Food Programme
James Wade, Student, Georgia Institute of Technology, 400 17th St. NW #2409, Atlanta, GA, 30363, United States of America, j.wade@gatech.edu, Manuel Jimenez, Lawrence Li, Alvaro Morales, Ozlem Ergun, Santiago Aviles, Elhadj Bah

We will discuss our work with WFP, food aid arm of the United Nations, to improve supply chain performance in ongoing (non-emergency) operations. An inventory-ordering tool was created to help standardize inventory policies and aid in decision-making. The team also built an optimization model of the global supply chain network to investigate the effects of proposed strategic changes such as pre-positioning. Preliminary results have predicted savings and increases in service levels.

Tuesday, 1:30pm - 3:00pm

■ TC01

C-Room 21, Upper Level

Risk in Portfolio Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu

1 - Managing a Portfolio of Risks
Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu, Igor Linkov

We describe several key steps in applying DA to a portfolio of risks. First, we frame the portfolio and map it to a portfolio of decisions. Alternatives include allocation of funds to reduction activities for each risk, but may be more specific, e.g., mitigation, amelioration, diversification, and sharing. Risk interactions such as correlation and causal relationships must be efficiently characterized. Value functions are designed to consider significant losses across multiple dimensions.

2 - Using Portfolio Objectives to Define and Manage Portfolio Risk
Jack Kloeber, Kromite LLC, 12 Penns Trail, Newtown, PA, 18940, United States of America, jkloeber@kromite.com

In R&D organizations, budget, talent, time, constrain the number and size of R&D projects which can be resourced. Organizational objectives drive us to choose which project strategies should be funded. Since R&D is inherently risky, management needs a process for taking portfolio risk, not project risk, into account when making such decisions. We will discuss methods for accomplishing this, as well give examples of lost value when portfolio risk is ignored.

3 - A Simple Mean-risk Model with Behavioral and Prescriptive Flexibility
Alessandra Cillo, Assistant Professor, IESE, Avenida Pearson 21, Barcelona, 08034, Spain, acillo@iese.edu, Philippe Delquie

We propose a behavioral Mean-Risk model that fulfills first and second order stochastic dominance generalizing results on Mean-Gini, and the axioms of Convex Risk Measures. It produces behavior intermediary between Expected Utility and Rank-Dependent Utility. Model's predictions in asset trading and allocation are provided.

4 - Portfolio Optimization of Natural Resources with an Application to the Management of Forest Stands
Janne Kettunen, Assistant Professor, University of Calgary, Haskayne School of Business, Calgary, AB, T2N 1N4, Canada jkettunen@london.edu, Ahti Salo

We develop a stochastic optimization model for a forest owner who needs to determine medium-term harvesting strategies under uncertainty about timber prices. Risks are managed by applying conditional value at risk and satisfying risk measures. The results suggest that extreme risks can be significantly reduced without appreciable reductions in the expected proceeds from timber sales. The results also suggest that risk averse owners tend to harvest their forests earlier than risk neutral owners.

■ TC02

C-Room 22, Upper Level

Bayesian Simulation and Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jason Merrick, Associate Professor, Virginia Commonwealth University, Richmond, VA, 23084, jrmerric@vcu.edu

1 - Bayesian Simulation and Decision Analysis: An Expository Survey
Jason Merrick, Associate Professor, Virginia Commonwealth University, Richmond, VA, 23084, jrmerric@vcu.edu

Research into Bayesian analysis of computer simulations has appeared mostly in the simulation, not decision analysis, literature. The hope is that this expository survey will engender more work in the area by decision analysts. We discuss the main areas of research: input analysis, propagation and estimation of output uncertainty, output analysis, making decisions with simulations, selecting the best simulated system, and applications of Bayesian simulation methods.

2 - A Bayesian Model for Sampling Correlated Inputs
Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu, Canan Gunes

We consider a stochastic simulation with inputs having Normal-To-Anything (NORTA) distribution. Utilizing Sklar's marginal-copula representation together with Cooke's copula-vine specification, we derive a copula-based representation for the NORTA distribution and develop a Bayesian model for the fast sampling of the NORTA parameters. We use the Bayesian model for capturing stochastic uncertainty and multivariate parameter uncertainty in stochastic simulations.

3 - Incorporating Constraints in Bayesian Multiattribute Ranking and Selection
John Butler, Clinical Professor of Finance, University of Texas at Austin, Finance Department, Mail Code B6600, 1 University Station, Austin, TX, 78712, United States of America, John.Butler2@mccombs.utexas.edu

Designers of complex systems are faced with a series of challenging problems. Beyond the inability to precisely specify the relationship between design parameters and system outputs, the inherent uncertainly in the system can lead to variability in the performance estimates for each alternative. In this presentation we combine multiattribute utility theory and Bayesian ranking and selection procedures with a focus on the right way to think about a "constraint" on alternative performance.

4 - Regression with Dirichlet Process Mixtures of Generalized Linear Models
Lauren Hannah, Princeton University, Department of ORFE, Sherrerd Hall, Charlton St., Princeton, NJ, 08540, United States of America, lhannah@Princeton.EDU, David Blei, Warren Powell

High-dimensional, nonparametric regression is a notoriously difficult problem. We present a novel, flexible approach that uses a Dirichlet process prior to mix over both the covariates and response, which is modeled by a GLM. We give conditions for consistency and apply the method to several small problems with continuous and categorical covariates and continuous and count responses.

■ TC03

C-Room 23A, Upper Level

Multiple Objective Optimization: Applications

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Altannar Chinchuluun, Dr., University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, altannar@ufl.edu

1 - The Bicriterion Stochastic Knapsack Problem
Kim Allan Andersen, Professor, Aarhus School of Business, Aarhus University, Fuglesangs Alle 4, Aarhus V, 8210, Denmark, KIA@asb.dk, Lars Relund Nielsen, Daniele Pretolani, Matthias Ehrgott

We have a known capacity of a resource, and a finite set of projects. Each project requires some units of the resource which is not known in advance, but given by a discrete probability distribution with a finite number of outcomes. A selected project gives rise to two rewards, which only depend on the project chosen. The goal is to design a set of resource adaptive strategies for choosing the projects such that the total expected value of the two objective functions is maximized.

2 - From Tradeoffs-based to Tradeoffs-free Economics, MCDM and Optimization
Milan Zeleny, Professor Dr., Fordham University, 113 West 60th Street, New York, NY, 10023, United States of America, mzeleny@fordham.edu

We present new perspectives on Multiple Criteria Decision Making (MCDM) as they manifest themselves in economics, decision making and optimization through the shift from the traditional tradeoffs-based analysis to modern tradeoffs-free design. From optimizing the given we explore designing the optimal, from Pareto-optimal we move to the optimal. Some computational examples via De novo programming are also included.

3 - From Organizational Stratgegy to Optimal Product Roadmap
Ernest Forman, Dr., Department of Decision Science, School of Business, George Washington University, Washington, DC, 20052, United States of America, forman@gwu.edu, George Tome

Deciding on products/services to produce is a challenge that most companies face. Deciding when to produce the products as well is an even more difficult challenge. This talk will illustrate how an 'optimal' product roadmap can be produced based on an organizations strategic plan, hierarchy of objectives, alternative products/services, dependencies, and resource constraints. Two approaches will be illustrated to address the estimation of anticipated benefits over different time periods.

4 - On Two Multiobjective Combinatorial Optimization Problems
Altannar Chinchuluun, Dr., University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, altannar@ufl.edu, Ashwin Arulselvan

In this talk, we focus on two network optimization problems: an extension of the Critical Node Detection and the biobjective Steiner Minimum Tree problem. The problems have applications in several fields including telecommunications, management science and military strategic planning. We propose both exact and approximate solution techniques for solving these problems.

■ TC04

C-Room 23B, Upper Level

Operations Research Methods for Data Mining

Sponsor: Data Mining
Sponsored Session

Chair: Wei Jiang, United States of America, jiangwei08@gmail.com

1 - Fast Quantile-based Clustering for Large-scale Problems
Kyu-Hwan Jung, POSTECH, Engineering Building 4 Office 410, Pohang, 790-784, Korea, Republic of, onlyou7@postech.ac.kr, Jaewook Lee

In many quantile-based clustering algorithms a key computational bottleneck is the cluster labeling time of each data point which restricts the scalability of the methods. Here, we propose a general framework of quantile-based clustering using dynamical system and a novel method to speed up labeling time which is superlinear to the size of data. Various benchmark results are provided to show the effectiveness and efficiency of proposed method with application to image segmentation.

2 - Machine Learning for Rare Event Counts
Nuttha Lurponglukana-Strand, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287-5906, United States of America, nuttha@asu.edu, George Runger, Eugene Tuv, Alexander Borisov

Count data occurs in application areas such as traffic, health, Web mining and so forth. For rare events (such as accidents and Web conversions) many zero counts are expected and an appropriate loss function differs from traditional categorical or numerical choices. Machine learning models for zero-inflated Poisson data are considered here to enhance traditional methods.

3 - Support Vector Machine Learning in Energy Forward Markets
Alexander Malyscheff, University of Oklahoma, 202 W. Boyd, Room #124, Norman, United States of America, malyscheff@gmail.com, Theodore Trafalis

Kernel-based learning techniques such as support vector regression (SVR) derive the regression function based on training set data. In energy markets preliminary test set data is available through forward prices, which can be interpreted as averaging constraints on the regression function within specific time limits. In other words an average label for parts of the test set is known beforehand. We present a SVR formulation, which accounts for preliminary available information on the test set.

■ TC05

C-Room 23C, Upper Level

Panel Discussion: The Roles of Quality, Statistics and Reliability (QSR) in Energy-related Research Areas

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Moderator: Haitao Liao, Assistant Professor, Nuclear Engineering Department, Industrial & Information Engineering Department, 211 Pasqua Building, The University of Tennessee, Knoxville, TN, 37996, United States of America, hliao4@utk.edu

1 - The Roles of Quality, Statistics and Reliability (QSR) in Energy-related Research
Panelist: Haitao Liao, Assistant Professor, Nuclear Engineering Department, Industrial & Information Engineering Department, 211 Pasqua Building, The University of Tennessee, Knoxville, TN, 37996, United States of America, hliao4@utk.edu

Securing the current supply of energy while seeking renewable energy is of vital importance to the energy research community and the society. In this panel discussion session, experts conducting research in nuclear power, wind energy and energy systems will share their experiences and visions with the audience and discuss the major and potential roles of quality, statistics and reliability (QSR) in these energy-related research areas.

2 - Reliability Needs for Nuclear Power Life Extensions
Panelist: Wesley Hines, Professor, Nuclear Engineering Department, University of Tennessee, Knoxville, TN, 37996, United States of America, jhines2@utk.edu

The US currently has 104 nuclear power plants that provide 70% of the non-CO2 emitting electricity. With energy demands growing 40-50% in the next 20 years, the utilities and the Nuclear Regulatory Commission are investigating life extensions beyond 60 years. There are concerns that plants which were originally licensed for 30 years would not be safely operating past 60 years. This presentation will describe some risks inherent in "life beyond 60" and discuss some current research activities.

3 - Wind Energy: Performance, Quality, and Reliabilty
Panelist: Andrew Kusiak, Professor, University of Iowa, 2139 Seamans Center, Iowa City, IA, 52242-1527, United States of America, andrew-kusiak@uiowa.edu

A wind turbine includes systems, such as a rotor, gearbox, generator, and power electronics, all belonging to different engineering domains, yet, they are required to seamlessly optimize, e.g., the power produced, power quality, and reliability of various systems. Meeting these often conflicting objectives is a challenge. A novel optimization concept of wind turbines in the presence of conflicting objectives is discussed. Quality and reliability issues are highlighted.

4 - Data-Driven Maintenance of the Electricity Transmission System
Panelist: Sarah Ryan, Professor and Director of Graduate Education, Iowa State University, Dept of Industrial & Manufacturing Syste, 3004 Black Engineering Building, Ames, IA, 50011-2164, United States of America, smryan@iastate.edu

The US transmission system includes approximately 150,000 power transformers and 600,000 circuit breakers along with over 250,000 miles of high voltage lines. Equipment is operating beyond its intended life and is increasingly stressed by load growth and economically motivated transmission. Remote condition monitoring can improve maintenance decisions but is too costly to deploy everywhere. Recent research aims to use the data effectively and determine where best to gather it.

5 - Multiple Objective Models for Power Generation Expansion Planning
Panelist: Abu Masud, Associate Dean, Professor, Wichita State University, 107 Jardine Hall, 1845 N. Fairmount, Wichita, KS, 67260, United States of America, Abu.Masud@wichita.edu

We have developed three related models for power generation expansion planning that incorporate multiple, conflicting objectives. These models have been explained with the help of a case study involving Mexican power generation planning.

■ TC06

C-Room 24A, Upper Level

Advances in Computer Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Roshan Vengazhiyil, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu

1 - Analysis of Computer Experiments with Functional Response
Ying Hung, Assistant Professor, Department of Statistics, Rutgers, the State University of New Jersey, Department of Statistics, 110 Frelinghuysen Road, Picataway, NJ, 08854, United States of America, yhung@stat.rutgers.edu, Roshan Vengazhiyil, Shreyes Melkote

Most existing methods for analyzing computer experiments with single outputs such as kriging cannot be easily extended to functional outputs due to the computational problems caused by high-dimensionality of the response. In this paper, we propose a sequential kriging procedure to overcome the computational problems. The proposed method is illustrated using a computer experiment conducted for optimizing residual stresses in machined products.

2 - Regression-Based Inverse Distance Weighting for Multivariate Interpolation
Lulu Kang, Ph.D. Candidate, School of Industrial and Systems Engineering, Georgia Tech, 350440 Gerogia Tech Station, Atlanta, GA, 30332, United States of America, lulu@gatech.edu, Roshan Vengazhiyil

Inverse distance weighting is a simple method for multivariate interpolation but has poor prediction accuracy. In this article we show that the prediction accuracy can be substantially improved by integrating it with the usual regression methods. This new predictor is quite flexible, computationally efficient, and works well in problems having high dimensions and/or large data sets. We also develop a heuristic method for constructing confidence intervals for prediction.

3 - Sparse Approximation of Gaussian Process Regression
Chiwoo Park, Researcher, Texas A&M University, 241 Zachry Engineering Research Center, Texas A&M University, 3131 TAMU, College Station, TX, 77843-3131, United States of America, chiwoo.park@gmail.com, Yu Ding, Jianhua Huang

We present a computationally efficient method to estimate posterior distributions of the unobserved points given the discrete observations oversampled from an assumed Gaussian random field. The basic idea is to use a few sparsely located points rather than the whole set of the observations. We provide a systematic way to choose the sparse points.

4 - SDACE: Sequential Design and Analysis of Computer Experiments
Ben Haaland, Department of Statistics, UW-Madison, 1300 University Ave., Madison, WI, 53706, United States of America, benhaaland@hotmail.com, Peter Qian

A sequential approach to gathering data and building accurate emulators for expensive computer experiments is proposed. The approach minimizes the number of observations from the computer experiment, allows confidence statements to be made about the emulator's error rate, and has good numerical properties. Issues addressed include data collection, variance estimation, stopping rules, and numerical stability.

■ TC07

C-Room 24B, Upper Level

Advanced Multivariate Data Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qingyu Yang, Research Fellow, University of Michigan,Industrial and Operations Engineering Department, 1815 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, qiyang@umich.edu

1 - Predicting Hind Limb Muscular Activity Using Neuronal Activities in Primary Motor Cotrex
Hang Zhang, Postdoctoral Research Associate, Arizona State University, Tempe, AZ, 85287, United States of America, hzhang12@mainex1.asu.edu, Chaolin Ma, Jiping He

In order to investigate the association between cortical and hind limb muscular activities, and ultimately to resume locomotion functions for paralysis, we build a finite impulse response model to predict hind limb muscular activities using neuronal activities in primary motor cortex when monkeys are conducting standing and squatting tasks.

2 - A Visualization Decision Support Tool for Multivariate SPC Diagnosis Using Marginal CUSUM Glyphs
Shing Chang, Associate Professor, Kansas State University, 2028 Durland Hall, Industrial and Manufacturing Systems Eng, Manhattan, KS, 66506, United States of America, changs@ksu.edu, Shih-Hsiung Chou

Traditional multivariate control charts combine information from various responses to one value e.g. Hotelling's T2 for process monitoring. Current diagnostic practice involves the use of procedures such as decomposition. In this research, we propose a marginal CUSUM glyph to visualize and decompose out-of-control signals over time. The proposed visualization tool, consisting of a two-sided CUSUM and star glyphs, is capable of indicating when and which variables contributing to the cause.

3 - Multi-Level Information Integration for System Performance Prediction
Jian Liu, Assistant Professor, University of Arizona, Department of Systems and Industrial Eng, The University of Arizona, Tucson, AZ, 85704, United States of America, jianliu@sie.arizona.edu, Jing Li

A complex system may consist of many levels of components and subsystems, whose performance are represented by multiple of random variables. We integrate experimental tests and a priori knowledge on those variables at different levels. By incorporating the component/subsystem interdependency information, a more accurate prediction of system performance is provided.

4 - Monitoring of 3-Dimensional Profiles Using Complex PCA
Qingyu Yang, Research Fellow, University of Michigan,Industrial and Operations Engineering Department, 1815 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, qiyang@umich.edu, Judy Jin

Profile monitoring has received increasing attention recently in quality engineering research. Most of exiting methods focus on monitoring of single profile data. In this research, a new method is proposed to monitor high-dimensional profile data in 3D space, in which complex principle component analysis is used to address the cross correlation between the profiles in different dimensions. The proposed method is demonstrated by monitoring process vibration in 3D space for a hot rolling process.

■ TC08

C-Room 24C, Upper Level

Data Mining for Business Support

Sponsor: Data Mining
Sponsored Session

Chair: Errol Caby, AT&T Labs, 180 Park Ave, Room B184, Florham Park, NJ, 08801, United States of America, ecaby@att.com

1 - Mining User-Supplied Data

Errol Caby, AT&T Labs, 180 Park Ave, Room B184, Florham Park, NJ, 08801, United States of America, ecaby@att.com

In this paper, we look at issues involved in mining user-supplied data and describe an approach that was used to extract information from the data. This approach uses third-party data to both regularize the user-supplied data and to help fill in missing data.

2 - A New Model for Behavioral Customer Segmentation

Erick Moreno-Centeno, PhD. Candidate, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, United States of America, erick_moreno@berkeley.edu, Rodolfo Catena, Phillip Yelland, Dorit Hochbaum

This study considers how to process commercial data from SUN Microsystems in order to provide insights on the rate of new product adoption by the company's consumers. We use a novel optimization model for data mining that minimizes the sum of deviations from pairwise comparisons and deviations from priors on the customers' behaviors. We analyze the results with respect to various dimensions of the customer base and report on the generated insights.

3 - NLP and Text Mining: An Application Proposal for Reader Comments in Online Journals

Behlül Çaliskan, Research Assistent, Marmara Universitesi Nisantasi Kampusu, Iletisim Fakultesi, Dr. Celal Oker Sk. No: 14/7 Harbiye, Sisli /Istanbul, Turkey, behlul.caliskan@marmara.edu.tr

Extracting semantic relationships between entities mentioned in text documents is an important task in natural language processing (NLP). The various types of relationships that are discovered can provide useful structured information to a text mining (TM) system. In this presentation, the ways of integrating NLP techniques to solve a TM problem will be examined, some new applications for TM will be looked at and a TM application proposal for reader comments in online journals will be offered.

■ TC09

C-Room 25A, Upper Level

Joint Session APS/MIF: Scheduling in Queueing Systems

Sponsor: Applied Probability & Minority Issues Forum
Sponsored Session

Chair: Nilay Argon, Assistant Professor, University of North Carolina, 333 Hanes Hall, Chapel Hill, NC, 27599, nilay@unc.edu

1 - Optimal Control of a Two-Class Call Center with Abandonments

Mark Lewis, Associate Professor, Cornell University, 226 Rhodes Hall, Ithaca, NY, 14853, United States of America, mel47@cornell.edu, Douglas Down, Ger Koole

We consider a two-class call center with abandonments. In the first model, holding costs and abandonment penalties are considered. In the second model, rewards for service completion are considered. In each case, we discuss dynamic, optimal control.

2 - Managing Queues with Heterogeneous Servers

Rhonda Righter, IEOR Department, UC Berekely, Berkeley, 94720, United States of America, Rrighter@ieor.berkeley.edu, Jung Hyun Kim, Hyun-soo Ahn

We consider several versions of the job assignment problem with servers of different speeds. When there are two classes of customers, primary and secondary, we develop an intuitive proof that the optimal policy that minimizes mean waiting time. We also apply our key argument to the classical slow-server problem, and obtain more general results for the two-server case and strengthen existing results for more than two servers.

3 - Scheduling Impatient Jobs in a Clearing System with Multiple Servers

Evin Uzun, UNC-Chapel Hill, 800 Pritchard Ave Ext H2, Chapel Hill, NC, 27516, United States of America, evin@email.unc.edu, Nilay Argon, Serhan Ziya

We consider a clearing system with multiple servers and a fixed number of jobs that are impatient. Jobs can be classified based on their lifetime, service time, and reward distributions. The objective is to maximize the expected total rewards earned. We find conditions under which the optimal dynamic policy may depend on the state, and under which it does not. Based on these characterizations, we develop easy-to-implement heuristic policies and test their performances by numerical experiments.

■ TC10

C-Room 25B, Upper Level

Joint Session QSR/ HAS: Defining the Science of Quality in Health Care

Sponsor: Quality, Statistics and Reliability & Health Applications
Sponsored Session

Chair: John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

1 - Service Science: Going Beyond I Know it When I See It

Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

Science has a structure composed of theory, theorems, methodologies and ontologies unique to each discipline. Absent a theoretical context all available information will seem equally relevant. What are the challenges in defining the science of health care quality?

2 - Operational Challenges in Measuring Quality in a School of Medicine: Perspective of a Dean

David Brenner, Vice Chancelleor, UCSD School of Medicine, 9500 Gilman Drive, La Jolla, CA, United States of America, dbrenner@ucsd.edu

Schools of medicine are a complex confederation of competing interests. Measuring the Quality of the total enterprise is ill defined but must encompass measures of quality in teaching, research, community responsiveness as well as management of fluctuating budgets, political expectations and, ultimately, identifying future directions and priorities.

3 - Life at 40,000 Feet Facing Anti-aircraft Fire: Perspective of a Hospital CEO

Richard Liekweg, CEO, UC San Diego Medical Center, 200 West Arbor Drive, San Diego, CA, 92103-8970, United States of America, rliekweg@UCSD.EDU

Numerous studies examine methods to improve hospital function ranging from inventory control and operating room scheduling through predicting emergency room demand and discrete event simulation of patient throughput. All fail to capture the realities confronting Hospital Management. This paper will discuss a CEO's perspective of the regulatory, organizational, community and staffing challenges of a modern hospital system

4 - Your Money's Worth: Research Questions in Quality Health Care Service

Cerry Klein, National Science Foundation, National Science Foundation, Wahington D.C., United States of America, cklein@nsf.gov

NSF funds basic research in Systems Enterprise Engineering. Most applications address basic methodologies. All too frequently the proposed methodological investigations are independent of actual challenges in measuring or improving quality in health care and/or lack a theoretical orientation that would explore what health care quality research might be. This presentation will discuss the value of grounding methodology in the science of health care quality.

■ TC11

C-Room 25C, Upper Level

Control and Design of Queueing Systems

Cluster: Queueing Models
Invited Session

Chair: Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@unc.edu

1 - Herding in Two Queues

Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We model customer herd behavior in two parallel queues when they observe queue lengths. The effect of congestion on her behavior is significant. In low traffic, herd behavior is pronounced. Herd behavior is dependent on the total queue length in the market, in addition to the relative queue lengths in the market.

2 - Staffing and Routing of Queueing Systems in the ED+QED Regime

Mor Armony, New York University, 44 West 4th Street #8-62, New York, NY, 10012, marmony@stern.nyu.edu, Avishai Mandelbaum

In large-scale service systems such as call centers the manager needs to determine staffing levels and routing rules. We formulate the problem of determining staffing and routing so as to minimize staffing cost subject to commonly used service level constraints on the tail of the waiting time distribution. We solve this problem asymptotically and show that the resulting ED+QED operating regime is significantly simpler than the commonly studied QED regime.

3 - Strategies for a Single Product Multi-Class M/G/1 Make-to-Stock Queue Serving Different Markets

Hossein Abouee Mehrizi, Rotman School of Management, 105 St. George Street, Toronto, Canada, H.AboueeMehrizi07@Rotman.Utoronto.Ca, Baris Balcioglu, Opher Baron

For an M/G/1 make-to-stock queue with prioritized customers and an identical product, we analyze the strict-priority and rationing policies when the inventory is centralized. We present an efficient algorithm to get the optimal rationing levels. For the case with decentralized inventory, we present the exact analysis of dispatching policy. We show that this policy is optimal in a make-to-order system.

4 - On The Relationships Among Traffic Load, Capacity, and Throughput for Finite Capacity Queues

Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@unc.edu

With some exceptions, throughputs of finite capacity queues typically increase with additional capacity. We investigate how this improvement depends on the traffic load. Specifically, for the M/G/c/c queue, we show that throughput improvement that would be obtained by adding an extra server is increasing in traffic load. For the M/M/1/m and M/G/1/m-PS queues, we show that throughput improvement that would be obtained by adding an extra buffer space is unimodal in traffic load.

■ TC12

C-Room 26A, Upper Level

Integer Programming and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Branching on Hyperplanes for Mixed Integer Programs

Bala Krishnamoorthy, Washington State University, Pullman, WA, United States of America, kbala@wsu.edu, Keith Clawson, Ye Tian

We consider strategies for branching on hyperplanes, rather than branching on variables, for MIPs. The hyperplanes are identified by basis reduction calculations. Previously, such techniques have proven effective for knapsack problems and marketshare IPs. We extend these techniques to MIPs, and apply them to various problems from the MIPLIB. We discuss cases where they proved effective, and ones for which they made the solution process harder than when using normal branching.

2 - Basis Reduction and the Complexity of Branch-and-Bound

Mustafa Kemal Tural, Dept of Statistics and Operations Research, UNC Chapel Hill, Hanes Hall, Chapel Hill, NC, 27599, United States of America, tural@email.unc.edu, Gabor Pataki

Branch and bound (BB) is a classical method to solve integer programming problems. In this work, we show that BB is efficient, if we apply a simple transformation in advance to the constraint matrix of the problem. We prove that if the coefficients are drawn from 1,...,M for a sufficiently large M, then for almost all such instances number of nodes enumerated by BB is at most 1. We give some numerical values of M which make sure that 99 percent of the reformulated problems solve at the rootnode.

3 - Structural Search and Optimization in Social Networks

Milind Dawande, Professor, University of Texas at Dallas, 800 West Campbell Rd. SM30, School of Management, Richardson, TX, 75080, United States of America, milind@utdallas.edu, Yunxia Zhu, Vijay Mookerjee, Chelliah Sriskandarajah

The explosive growth in the variety and size of social networks has focused attention on searching them for fundamental set-based structures. We discuss algorithmic results for two search problems based on the notions of influential and central sets in the network that highlight, respectively, the specific role and specific location of a set.

4 - A New Heuristic for General Mixed Integer Programming

Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, Kuo-Ling Huang

We present a new heuristic for rounding a continuous solution to a mixed integer solution in integer programming. The heuristic is based combining three ideas: (i) successively enlarging a simple ellipsoid, finding integer solutions in this ellipsoid, without letting a solution escape; (ii) performing a random walk in the continuous relaxation; (iii) using a feasibility pump. Numerical results will be presented.

■ TC13

C-Room 26B, Upper Level

Computational Optimization for Logistics Applications

Sponsor: Computing Society
Sponsored Session

Chair: David Woodruff, Professor, University of California Davis, UC Davis, Davis, CA 95616, Davis, CA, United States of America, dlwoodruff@ucdavis.edu

1 - Adaptive Granular Local Search for a Dynamic Vehicle Routing Problem

Arne Lokketangen, Professor, Molde University College, Postboks 2110, Molde, N-6402, Norway, Arne.Lokketangen@HiMolde.no, Vinicius Armentano, Rodrigo Branchini

City distribution often entails dynamic updating of customer requests. We describe the use of granular local search for such a problem, where the granularity depends on the available search time. We assess our system on test problems based on real-life Brazilian transportation companies.

2 - Maritime Distribution of Stone Products

Johan Oppen, Associate Professor, Molde University College, Postboks 2110, Molde, N-6402, Norway, Johan.Oppen@himolde.no

The Norwegian company NorStone has a yearly production of 8 mill. tons of stone products. The products are mainly transported by sea, and varying demand throughout the year together with limited inventory capacities make the task of distribution planning quite challenging. We present a problem description and a mathematical model for this inventory and distribution problem. Possible solution methods are also discussed.

3 - Implementation of a Decomposition Method in Solving Biofuel Supply Chain Problems under Uncertainty

Yueyue Fan, Associate Professor, UC Davis, Department of Civil Engineering, One Shields Avenue, Davis, CA, 95616, United States of America, yyfan@ucdavis.edu, Chien-Wei Chen

A two-stage stochastic programming model is formulated to optimize the entire supply chain system for bioethanol production from biowastes to hedge against fuel demand uncertainties. A decomposition method based on Lagrange relaxation, progressive hedging method, is sought to overcome the computational challenges involved in this large-scale mixed integer problem.

4 - A RAMP Approach to the Resource Constrained Project Scheduling Problem

Chris Riley, University of Mississippi, School of Business Administration, Oxford, MS, 38677, United States of America, criley@bus.olemiss.edu, Cesar Rego, Haitao Li

A Relaxation Adaptive Memory Programming (RAMP) algorithm is developed to solve large-scale resource constrained project scheduling problems (RCPSP). The RAMP algorithm presented here takes advantage of a cross-parametric relaxation and extends a recent approach that casts the relaxed problem as a minimum cut problem. Computational results will be presented and discussed.

■ TC14

C-Room 27A, Upper Level

Optimization in Practice V - Modeling

Sponsor: Computing Society
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

Co-Chair: Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

1 - Smoothing the Transition to Optimal Solutions
Ed Klotz, CPLEX Product Expert, ILOG, an IBM Company, 889 Alder Avenue, Suite 301, Incline Village, NV, 89451, United States of America, klotz@us.ibm.com

Optimal solutions to Mixed Integer Programs are very useful when configuring a new physical system. However, they may impose too many changes to easily implement when modeling currently operational systems. In such models, a sequence of feasible solutions that improve the objective while incrementally changing the current operations can smooth the transition process. We will discuss recent advances in the ILOG CPLEX Optimizer that facilitate the generation of such a sequence of solutions.

2 - GAMS – Features You Might Not Know About
Alex Meeraus, President, GAMS Development Corporation, 1217 Potomac Street NW, Washington, DC, 20007, ameeraus@gams.com

In the last decade the General Algebraic Modeling System (GAMS) has been improved in various ways. Some of the improvements are visible and known to most of the users like the availability of new solvers or changes you can see in the integrated development environment. Others are more hidden and the user might not know that these exist like the Macro Facility and the Matching Operator. In this talk we give an overview of features which were added in the recent and not so recent past.

3 - Recent News and Trends in Optimization and Modeling
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

In this presentation, we will cover several major news and noteworthy trends in optimization that occurred during the past year, including: current state-of-the-art in optimization and modeling. The new MPL FREE Development and Academic Programs. New solvers from GUROBI and Microsoft. Purchase of ILOG and DASH by IBM and Fair Isaac. Emergence of grids, clouds and virtual machines and their impact on the field of optimization.

■ TC15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Frontline Systems, Inc. - Risk Analysis and Robust Optimal Solutions: High Productivity Modeling in Excel
Daniel Fylstra, President, Frontline Systems Inc., 913 Tahoe Blvd., #7, Incline Village, NV, 89450, United States of America, dfylstra@frontsys.com

The path to better decisions can be shorter: More than ever, models for risk analysis and optimal resource allocation in the presence of uncertainty can be built more easily, scaled up to large size, and solved more effectively in Microsoft Excel. Robust optimization and stochastic programming models that once required scarce expertise and long development cycles are easy to create and solve in Excel. Software that exploits multi-core PCs in both optimization and simulation yields faster-than-ever solutions. This session focuses on how practitioners can build models, get results quickly, and create reports, charts and graphs to communicate results to decision-makers.

2 - SAS - Building and Solving Optimization Models with OPTMODEL
Ed Hughes, Product Manager, SAS/OR, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27513, United States of America, Ed.Hughes@sas.com, Trevor Kearney

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

■ TC16

C-Room 28A, Upper Level

Joint Session IS/eBusiness: Internet Search and Advertising Auctions

Sponsor: Information Systems & eBusiness
Sponsored Session

Chair: De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E, Lexington, KY, 40506, United States of America, de.liu@uky.edu

1 - Clicktracks: Understanding Consumers' Online Search and Information Retrieval
Vandana Ramachandran, Assistant Professor, University of Utah, Department of Operations and Info. Sys., 1645 East Campus Center Drive, Salt Lake City, UT, 84112-9301, vandana@business.utah.edu

We study consumers' online search and information-seeking patterns in an online retail context for durable goods. Using clickstream data, we determine the optimal configuration of promotional information and messages that should be provided by sellers to help improve online purchase-related outcomes. Our findings provide several implications for sellers to devise targeted and customized information-provision at appropriate stages in consumers' shopping cycles.

2 - User-Generated Content in Mobile Digital Media
Sang Pil Han, Post-Doctoral Researcher, NYU Stern, 44 West 4th Street, New York, United States of America, shan2@stern.nyu.edu, Anindya Ghose

Consumer adoption and usage of mobile communication and multimedia content services has been growing steadily over the past few years in many countries around the world. We develop and estimate a structural model of user behavior and learning with regard to content generation and usage activities in mobile digital media environments.

3 - A Theory of Payment Schemes
De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E, Lexington, KY, 40506, United States of America, de.liu@uky.edu, Siva Viswanathan

A variety of different payment schemes are adopted in Internet advertising, including pay-per-impression, pay-per-click, and pay-per-sales. We study the payment scheme choice in a setting where the ex-post value of advertising slots is determined by both the characteristics of the publisher and that of the advertiser. The publisher trades off between signaling his quality to advertisers and selecting the best advertisers.

■ TC17

C-Room 28B, Upper Level

The Impact of Social Networks, Contributor Incentives, and Proprietary Competitors on Open Source Development

Sponsor: e-Business
Sponsored Session

Chair: Terrence August, Assistant Professor, UCSD, Rady School of Management, 9500 Gilman Drive, MC 0553, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu

1 - Social Networks and Software Designs in Open Source and Closed Source Projects
Sandra Slaughter, Professor of Information Technology Management and Alton M. Costley Chair, Georgia Tech College of Management, 800 W. Peachtree St. NW, Atlanta, GA, 30308, United States of America, sandra.slaughter@mgt.gatech.edu, Chiara Francalanci, Francesco Merlo

This study proposes a symmetry between the social network structure of developers and the software designs they create. Analysis of longitudinal archival data collected on open source and closed source projects provides support for this hypothesis. However, the findings also reveal significant differences between the Open Source and Closed Source projects.

2 - Network Effects: The Influence of Structural Social Capital on Open Source Project Success

Yong Tan, Associate Professor of Information Systems, University of Washington, Foster School of Business, ytan@u.washington.edu, Param Singh, Vijay Mookerjee

This paper investigates the impact of network social capital - the benefits open source developers secure from their memberships in a developer collaboration network - on open source project success. Specific hypotheses are tested on a longitudinal panel of 2378 projects hosted at Sourceforge. We find that projects with greater internal cohesion, moderate external cohesion, moderate technological diversity, or greater number of direct and indirect external contacts are more successful.

3 - Commercializing Open Source Software: An Examination of Open Source Support Model

Byung Cho Kim, Assistant Professor, Virginia Tech, Business Information Technology, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu, Pei-yu Chen, Tridas Mukhopadhyay

We examine the issue of commercializing open source software (OSS). We investigate whether OSS support model is viable under competition with proprietary software. Our model considers the motivations for and the barriers to OSS adoption. We study the impact of a giant proprietary software vendor's participation in the OSS support market on the viability of OSS support model.

4 - Licensing Decisions and Competition for Integration and Services in Open Source Software

Terrence August, Assistant Professor, UCSD, Rady School of Management, 9500 Gilman Drive, MC 0553, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu, Tunay Tunca, Hyo duk Shin

In this paper, we explore firms' economic incentives to foster open source software initiatives in lieu of proprietary ones and the role of services in software development and value generation. We present an economic model that jointly analyzes software originators and subsequent contributors' investments in software development as well as pricing of software and services under competition.

■ TC18

C-Room 28C, Upper Level

Network Management and Design

Sponsor: Telecommunications
Sponsored Session

Chair: Jun Shu, Penn State University, 462 Business Bldg., University Park, PA, United States of America, junshu@psu.edu

1 - A Decision Model for Optimizing the Network Security Level for Organizations

Soumyo Moitra, Senior MTS, CERT/SEI, Carnegie Mellon, 4500 Forbes Ave, Pittsburgh, PA, 15213, United States of America, sdmoitra@hotmail.com

This paper presents a model to help managers decide on the most appropriate level of network security for their networked information systems. The model considers the costs of security as its level varies and the reduction in expected damages as a result of having that level of security. Various scenarios are constructed from publicly available data and the examples show how the optimal level of network security varies with different conditions.

2 - Information and Communications Technology Supply Chain Integrity

Jun Shu, Penn State University, 462 Business Bldg., University Park, PA, United States of America, junshu@psu.edu, Patrick McDaniel, Karl Rauscher, Thomas La Porta

Modern society is vitally dependent upon reliable and secure information and communications technology (ICT) infrastructure. Most ICT is developed through supply chains that are complex, and outsource to offshore workforces in less developed regions. The integrity of such supply chains and therefore development processes, is very difficult to observe, monitor and ensure. Our research aims to provide a structure and methods for measuring the integrity of ICT supply chains.

3 - Fuel Cells in Telecommunications Applications

Scott Grasman, Missouri S&T, Rolla, MO, 65409, United States of America, grasmans@mst.edu

This presentation addresses the potentially significant role and use of fuel cells in telecommunications. Technology status and growth, early market development, consumer behavior and attitudes, impact of infrastructure availability, and transitional dynamics of fuel cell technologies, infrastructure, and applications are analyzed, including the most significant obstacles, how these obstacles have been approached, and how this information can be used to encourage the use of fuel cells.

■ TC19

C-Room 28D, Upper Level

Joint Session TSL/OR-Societal Impact: Dynamic Evacuation Planning and Operations Models I

Sponsor: Transportation Science and Logistics & OR/MS with Societal/ Humanitarian Impact
Sponsored Session

Chair: Natalia Ruiz Juri, University of Texas at Austin, 6.204 ECJ Hall, 1 University Station C1761, Austin, United States of America, natiruizjuri@gmail.com

1 - Behavior-based Framework for Mass Evacuation

Yu Ting Hsu, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, IN, 47906, United States of America, yhsu@purdue.edu, Srinivas Peeta

We propose a behavior-based operational framework for mass evacuation that factors data availability. An aggregate model is developed to predict zonal behavior (evacuation participation and route choice) in terms of inter-zonal flows in response to information and observable dynamics. In addition, a disaggregate model is proposed to represent individual behavior and incorporated into the framework. Issues are identified and solution directions are discussed.

2 - Optimal Control Strategies for Massive Vehicular Pedestrian Mixed Flows in the Evacuation Zone

Xin Zhang, University of Maryland, 11324 Evans Trail, Apt 201, Beltsville, MD, 20705, United States of America, zhangxin@umd.edu, Gang-Len Chang

This paper presents an integrated model for design of signal plans for massive mixed pedestrian-vehicle flows within the evacuation zone. The proposed model with its embedded formulations for pedestrians and vehicles in the same network can effectively take into their potential conflicts during the evacuation, and generate the optimal routing strategies for guiding evacuees moving toward either the pick-up locations or their parking areas.

3 - A Multi-agent Simulation Incorporating Traffic Behavior for Hurricane Evacuation

Bo Zhang, Rensselaer Polytechnic Institute, CII 5015, 110 8th St., Troy, NY, 12180, United States of America, zhangb5@rpi.edu, W.K. Victor Chan, Satish Ukkusuri

This work presents a multi-agent simulation model for hurricane evacuation based on behavior-oriented agents. The action rules of diverse groups of agents are extensive survey data. We develop the traffic behavior and their interactions during the evacuation process using the set of action rules. We simulate the multi-agent model and obtain insights related to traffic behavior during hurricane evacuations.

4 - Accounting for Information Collection and Utilization in the Routing of Emergency Response Vehicles

Natalia Ruiz Juri, University of Texas at Austin, 6.204 ECJ Hall, 1 University Station C1761, Austin, TX, United States of America, natiruizjuri@gmail.com, Travis Waller

We introduce novel routing strategies which account for the capability of emergency vehicles and other assets to retrieve information about the experienced system state as they traverse it. The proposed models simultaneously address the collection and utilization of real-time information in routing problems on stochastic networks. Exact and heuristic methodologies are implemented to the solution of various numerical examples which demonstrate the potential benefits of the new strategies.

■ TC20

C-Room 28E, Upper Level

Joint Session TSL/OR-Societal Impact: Dynamic Evacuation Planning and Operations Models II

Sponsor: Transportation Science and Logistics & OR/MS with Societal/ Humanitarian Impact
Sponsored Session

Chair: Sirui Liu, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, lius77@vt.edu

1 - A Bi-level Optimization Model to Determine a Control Area for Emergency Evacuation Operations

Yue Liu, Research Assistant, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States of America, troybest@umd.edu, Jie Yu, Gang-Len Chang

This paper presents a bi-level model for use in generating a control area for evacuation operations. The high-level optimization aims to maximize the throughput during the specified evacuation duration, while the low-level intends to minimize the control area size to save limited manpower and resources if the specified duration is sufficient for evacuating all demands. Evaluation results from numerical studies in the Baltimore Region network have demonstrated the model's promising properties.

2 - Formulation and Solution Method for Optimal Gas Refueling Station Locations for Hurricane Evacuation

Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Shuo Wang, Yang Gao, Simge Kucukyavuz

We formulate the optimal gas refueling station location problem as an stochastic mixed integer program in a optimization-simulation framework. The solution procedure is integrated with the DTA model DynusT in that DynusT evaluates the intermediate solution and provides feedback with optimization model. The model was tested on a case study of IH-45 corridor between Houston and Dallas, USA.

3 - Optimization and Simulation Based Model to Select Facility Relocation Sites for No-notice Evacuation

Sirui Liu, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, lius77@vt.edu, Pam Murray-Tuite

We introduce an optimization model to determine optimal relocation sites for facilities with a large amount of dependents to be picked up under no-notice evacuation. A procedure involving iterative runs between this optimization model and the simulation model is developed and a case study in Chicago Heights is tested.

■ TC21

C-Room 30B, Upper Level

Warehouse Operations II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - State Dependent Queueing Models of Material Handling Systems

James MacGregor Smith, Professor, University of Massachusetts, 160 Govenors Drive, Amherst, MA, 01003, United States of America, jmsmith@ecs.umass.edu

Analytical models of material handling systems (MHS) which provide accurate, fast and efficient methods are desireable. Most models of MHS are simulation models. Using state dependent queues, we develop closed queueing network (CQN) models capable of providing a topological network design (TND) tool for these MHS. Numerous computational experiments are included to round out the presentation.

2 - Performance Evaluation of Zone Picking Systems

Ivo Adan, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, iadan@win.tue.nl

Zone picking systems employ a picking concept where the operators are going to the goods, and each operator is responsible for the goods stored in a certain area or zone. A zone picking system can be modeled as a multi-class closed queueing network with finite buffers and so-called jump-over-blocking. We show that important performance such as throughput and utilization of operators can be efficiently and accurately evaluated by employing aggregation and decomposition techniques.

3 - Vehicle Interference Effects in Autonomous Vehicles Based Warehousing Using Systems

Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu, Charles Malmborg, Sunderesh Heragu, Debjit Roy

Warehouses that use autonomous vehicles for storage and retrieval operations within multi-tier racking systems rely on vehicles to provide horizontal the movement within a tier and use lifts to provide vertical movement between tiers. In this research, vehicle interference effects on throughput and cycle times are studied using queuing models. The models are validated using detailed simulations.

■ TC22

C-Room 30C, Upper Level

Risk Management in Supply Chains II

Contributed Session

Chair: Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

1 - On Optimal Continuous Replenishment Rates for Stochastic Inventory Systems under Lost-sales Rules

Junmin Shi, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States of America, jshi@pegasus.rutgers.edu, Benjamin Melamed, Michael Katehakis

Consider a one-product inventory system with a constant replenishment rate under Poisson demands and lost sales. The system incurs a carrying cost and lost-sale penalty. We derive an explicit expression for the time average cost. For exponentially distributed demands, we obtain the optimal replenishment rate. Further, we give numerical computations for other demand distributions.

2 - Optimal Policy Structure for Discrete State/Action Inventory Model with Random Yield

Chelsea White, H. Milton & Carolyn J. Stewart School Chair, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, cwhite@isye.gatech.edu, Tae Su Cheong, Alan Erera

We consider a discrete state/action infinite horizon, expected total discounted cost MDP model of a single product, periodic review inventory problem with lost-sales, deterministic demand, and random yield. We present conditions that guarantee the existence of an optimal policy d* such that d*(z)=0 for z<=0, and for z>0, d*(z)>=z and d*(z)-z is non-decreasing, and hence has a staircase structure in z, where z is unsatisfied demand.

3 - Applying Autopilot to Improve Scalability and Responsiveness in Supply Chain Network

Junfang Yu, Assistant Professor, Southern Methodist University, Dept of EMIS, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, yuj@lyle.smu.edu, Timothy Tsai, Jerrell Stracener

Scalability and responsiveness are two key elements to mitigate supply risk in a large, complex, and multi-tier supply chain network. Autopilot is an efficient control system designed for managing supply risk in near real-time. It uses real-time operation management collaboration to monitor, notify, and solve supply disruption or quality issue which could be engineering or business related. This presentation addresses the concepts, mechanism, design and implementation of such a system.

4 - Risk Assessment for the Security of Inbound Containers at U.S. Ports: A FMEA Approach

Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

A design of a decision support framework is proposed for a reliable cargo container shipment and handling system based on FMEA. The proposed prototype of a simple risk assessment system is offered that safeguards against potential security risks in cargo container shipments entering U.S. ports.

■ TC23

C-Room 30D, Upper Level

Modeling Human-Social-Cultural Terrain in the Operational Environment

Sponsor: Military Applications Society
Sponsored Session

Chair: Niki Goerger, ERDC LNO to ASA(ALT), US Army Engineer Research and Development Center, 7701 Telegraph Road, Kingman Bldg, Alexandria, VA, 22315, United States of America, niki.c.goerger@us.army.mil

1 - Recognizing Patterns of Anomie that Set the Conditions for Insurgency

Curtis Blais, Naval Postgraduate School, ME Building RM 269, 700 Dyer Road, Monterey, CA, 93943, United States of America, clblais@nps.edu, Robert Shearer, Karen Guttieri, Leroy (Jack) Jackson

A proactive approach to the insurgency problem requires analysis to begin before violence starts. This project proposes to identify patterns of anomie, the loss of compelling norms enabling populations to meaningfully interpret social change that helps facilitate insurgencies; categorize events that trigger their start, and simulate a nation state moving from peace to political violence. This presentation will provide a project overview along with progress to date and planned future efforts.

2 - Relationships and Influence in Cultural Geography Modeling

Leroy (Jack) Jackson, Senior Analyst & Deputy Director, US Army TRADOC Aalysis Center, P.O. Box 8695, Monterey, CA, 93933, United States of America, lajackso@nps.edu

This presentation will describe how relationships and influence are modeled in a cultural geography model of civilian populations in stability operations. The purpose of the model is to understand the response of the population to insurgent, government and stability force. This presentation will focus on relationship and influence modeling with social network theory and other social theories related to influence using persuasion, negotiation and coercion.

3 - Population and Infrastructure: Decision-Making in Theater

Timothy Perkins, US Army Corps of Engineers - ERDC-Champaign, ATTN: ATRC-RDM, P.O. Box 8692, Monterey, CA, 94943, United States of America, Timothy.K.Perkins@us.army.mil, Jeffrey Burkhalter

Decision-makers have limited ability to explore socio-cultural impacts of infrastructure projects on local populations. Work is underway to develop an exploratory analytical ability to simulate a variety of infrastructure projects in the Cultural Geography model to provide a prototypical method and implementation of data collection, analysis and representation facilitating a culturally-based analysis of infrastructure options in a Battalion area of operations.

4 - US Army Geospatial Center Support to the OSD Human Social Culture Behavior Modeling Program

Joseph Watts, Special Projects Officer, US Army Geospatial Center, 7001 Telegraph Road, Alexandria, VA, 22315, United States of America, Joseph.M.Watts@usace.army.mil, Dylan Schmorrow

The US Army Geospatial Center (AGC) is charged with oversight of the Army Geospatial Enterprise. A fundamental element of the AGC portfolio is the OSD Human Social Culture Behavior (HSCB) Modeling Program which is a five year R&D effort to develop a science base and associated technologies for modeling human, social and cultural behavior. AGC contributes program management, test and assessment, transition planning, geospatial modeling, and knowledge management engineering support.

■ TC25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Optimization in Flight Scheduling

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Binod Maharjan, Texas Tech University, Box # 43061, Lubbock, TX, United States of America, b.maharjan@ttu.edu

1 - Set-partitioning Model for Dynamic Adjustment to Air Traffic Control Sectors

Peng Cheng, Tsinghua University, Main Buidling 411, Beijing, China, chengp@tsinghua.edu.cn, Rui Geng

A set-partitioning model for dynamically adjusting air traffic control sectors is built to balance controllers' workload and to increase airspace capacity. The optimal number and specific forms of open sectors are given from the optimization model. A method to evaluate controllers' workload based on statistical analysis of historical radar data is proposed and applied to the set-partitioning model. Examples show that the model can get quick solutions to optimal sector configuration problems.

2 - Linear Network Structured Airline Periodic Aircraft Scheduling

Gerardo De la O, Texas Tech University, Box 43061, Lubbock, TX, 79409, United States of America, gerardo.o@ttu.edu, Yuanlin Zhang, Timothy Matis

For a linear network structured airline it is essential to regulate the spacing of consecutive flights that serve the same origin-destination city-pair and to find the optimal operational cost. In this study, we assume to know the number of aircrafts characterized by a unique identification number and their routes and we want to find, with numerical approaches, their paths which consider flight departure times that minimize the novel departure spill opportunity cost and on-land operational cost.

3 - A Hybrid Approach to Airline Crew Pairing Optimization

Jose L. Walteros, Departamento de Ingenieria Industrial, Universidad de los Andes, Carrera 1 Este # 19 A - 40, Bogota, Colombia, j-walter@uniandes.edu.co, Miguel A. Vargas, Diana Florez, Andrés L. Medaglia

This work proposes a solution approach for the single and multiday crew pairing problem considering layovers and deadheads. The strategy is comprised of: 1) a binary programming model; 2) a set partitioning (SP) model; 3) a set covering (SC) model; and 4) a split-based heuristic that follows the principle of route-first cluster-second. The SP and SC models are solved under a column generation scheme. The four models are compared using test instances from a real mid-sized airline.

4 - Flight Gate Reassignment Optimization Algorithm for Hub-spoke Airport

Binod Maharjan, Texas Tech University, 2500 Broadway, Lubbock, TX, binodm@gmail.com, Timothy Matis

The real time reassignment of gates due to flight delays at hub airports is a difficult task, and is generally done ad-hoc by gate managers. Our research develops a decision support tool with an embedded non-linear binary optimization routine that proactively reassigns gates to min fuel burn and overall passenger disruption on a fixed time interval while controlling the level of propagated reassignments. Specifically, gate mangers may use this tool to balance the tradeoff between optimal gate reassignment and minimization of gate assignment schedule disruption. We show that this tool is both computationally efficient and practically useful though several test cases.

■ TC26

C-Room 31B, Upper Level

Edelman Finalists Reprise - III

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

1 - Edelman Finalist: Operations Research Improves Sales Force Productivity at IBM

Richard Lawrence, IBM, 1195 West Fremont Avenue, Sunnyvale, CA 94087, United States of America ricklawr@us.ibm.com, Claudia Perlich

In 2009 IBM was recognized as a finalist of the INFORMS Edelman competition for its analytical initiatives to improve the productivity of its global salesforce. OnTARGET provides a set of predictive models designed to identify new sales opportunities and is available to over 13,000 sales reps. The Market Alignment Program allocate sales resources based on validated analytical estimates of revenue opportunity. The business impact is estimated to be in the hundreds of millions of dollars.

2 - CSX Uses OR to Cash in on Optimized Equipment Distribution

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu, Dharma Acharya, David Sellers

CSX implemented the U.S. rail industry's first real-time, fully integrated equipment distribution optimization system, the Dynamic Car Planning system (DCP). DCP allows the OR modeling to be seamlessly integrated into the process of assigning empty cars to customer car orders. CSX estimates it has saved $561 million and avoided $1.4 billion in capital expenditure. The public has benefited by an estimated $600 million from improved highway safety, congestion, and pollution.

■ TC27

C-Room 31C, Upper Level

Agent-based Modeling and Simulation: Overview and Mini-tutorial

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Charles Macal, Director, Center for Complex Adaptive Systems, Argonne National Laboratory, 9700 S. Cass Avenue, Decision & Information Sciences-Bldg 900, Argonne, IL, 60439, United States of America, macal@anl.gov

1 - Agent-based Modeling and Simulation: Overview and Mini-tutorial

Charles Macal, Director, Center for Complex Adaptive Systems, Argonne National Laboratory, 9700 S. Cass Avenue, Decision & Information Sciences-Bldg 900, Argonne, IL, 60439, United States of America, macal@anl.gov, North Michael

Agent-based modeling and simulation (ABMS) is a new approach to modeling systems comprised of autonomous, interacting agents. Complex adaptive systems, emergent behavior, and self-organization are a few of the notions from ABMS. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects, and the relationship of ABMS to conventional OR.

2 - Tutorial and Overview of Agent-based Modeling and Simulation and Complex Adaptive Systems

North Michael, Deputy Director, Complex Adaptive Systems Center, Argonne National Laboratory, 9700 S. Cass Avenue, Decision & Information Sciences Division, Argonne, IL, 60439, United States of America, north@anl.gov

Agent-based modeling and simulation (ABMS) is a novel approach to modeling systems comprised of interacting agents based on the complex adaptive systems (CAS) paradigm. ABMS is finding widespread application in many areas. This tutorial and overview presents the foundations of CAS and ABMS, approaches for developing agent models from spreadsheets to agent software toolkits, the relationship between ABMS and traditional techniques, and special challenges such as data and validation requirements.

■ TC28

H-Room 500, Fifth Floor

Network/Cargo Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Mikhail Nediak, School of Business, Queen's University, 143 Union str., Kingston, ON, K7L 3N6, Canada, mnediak@business.queensu.ca

1 - Nonlinearly Parameterized Basis Functions for Revenue Management

Dan Adelman, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, United States of America, dan.adelman@chicagobooth.edu, Canan Uckun

For a revenue management problem, we explore a strong functional form to approximate the optimal dynamic programming value function. Whereas much of the ADP literature employs weighted combinations of non-parametric basis functions, our basis functions are nonlinearly parameterized. We provide a solution methodology to solve the resulting non-linear program.

2 - Pricing Structure Optimization in Mixed Restricted/Unrestricted Fare Environments

Joern Meissner, Lancaster University Management School, Lancaster, LA1 4YX, United Kingdom joe@meiss.com, Arne Strauss

Recently, many traditional practitioners of revenue management were confronted with aggressive low-cost competition. In order to stay competitive, these firms responded by cutting down fare restrictions that were meant to fence off customer segments. We develop choice-based network revenue management approaches for such a mixed fare environment that can handle both the traditional opening or closing of restricted fare classes as well as handling pricing of the unrestricted fares simultaneously.

3 - An Improved Dynamic Programming Decomposition Approach for Network Revenue Management

Dan Zhang, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, dan.zhang@mcgill.ca

We consider a nonlinear non-separable functional approximation to the value function of a dynamic programming formulation of the network revenue management (RM) problem with customer choice. We propose a solution approach and show that the approach leads to a tighter upper bound on revenue than some known bounds in the literature. Our approach can be viewed as a variant of the classical resource-based dynamic programming decomposition approach. We report encouraging numerical results.

4 - Cargo Revenue Management with Flight Combination Allotments and Consumer Choice Behavior

Mikhail Nediak, School of Business, Queen's University, 143 Union Str., Kingston, ON, K7L 3N6, Canada, mnediak@business.queensu.ca, Yuri Levin, Huseyin Topaloglu

We consider a problem faced by an airline that operates parallel flights to transport cargo between groups of OD pairs. The airline can sell its capacity either through allotment contracts on the combination of flights or on the spot market with sales subject to consumer choice behavior. The goal is to choose allotment contracts among available bids, assign these contracts to flights, and find a booking control policy for the spot market so as to maximize the total expected profit.

■ TC29

H-Room 501, Fifth Floor

Uncertainty, Renewables, Transmission and the New Zealand Electricity Market

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

Chair: Golbon Zakeri, University of Auckland, 70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz

1 - Production Inefficiency of Markets with Hydro Generation

Andy B. Philpott, Professor, University of Auckland, 70 Symonds Street, Auckland, New Zealand, a.philpott@auckland.ac.nz, Golbon Zakeri, Geoff Pritchard, Javad Khazaei

Electricity market designs that decentralize decision making for participants can lead to inefficiencies in the presence of nonconvexity or missing markets. We describe the results of an empirical study of the New Zealand wholesale electricity market that attempts to identify and quantify the sources of any productive efficiency losses, by comparing market outcomes with a counterfactual central plan.

2 - Intermittent Generation and Capacity Expansion in the Electricity Sector: A MIP-based Analysis

Phil Bishop, Senior Economist, Electricity Commission, Level 7 ASB Bank Tower, P.O. Box 10041, Wellington, 6143, New Zealand, Phil.Bishop@electricitycommission.govt.nz, Erwan Hemery

The New Zealand electricity sector is characterized by a long, radialized grid with load and generation capacity largely spatially separated. Intermittent renewables, particularly wind, will account for a significant share of future generation capacity. Moreover, much of it will be located some distance from the existing grid. Transmission investment and transmission pricing policies in this environment are analyzed using a large MIP model.

3 - Scenario Generation for Wind Power Production

Geoff Pritchard, University of Auckland, Dept of Statistics, Private Bag 92019, Auckland, New Zealand, g.pritchard@auckland.ac.nz

Power-system optimization problems are sometimes formulated with a collection of scenarios for wind power generation, rather than a single best forecast. These scenario-sets need to be different at different times, because some meteorological situations are inherently more uncertain than others. We use a quantile regression technique to generate scenarios of this kind for short time horizons (less than 6 hours).

4 - Carbon Charges in Electricity Market with Transmission Capacities

Anthony Downward, Mr, University of Auckland, 70 Symonds Street, CBD, Auckland, New Zealand, a.downward@auckland.ac.nz

We examine the effect that introducing a carbon tax may have on electricity markets. We model generators as Cournot players over an electricity grid with line capacities. The impact that a charge for Carbon emissions has on the behaviour of the generators is compared under two different assumptions about generators' rationality. We find that in certain situations total social welfare increases after the tax is applied, however it is possible that emissions of carbon dioxide can also increase.

■ TC30

H-Room 502, Fifth Floor

Underground Mining Applications

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

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, anewman@mines.edu

1 - A Stochastic Approach for Copper Mine Planning
Felipe Carvalla, Universidad de Chile, lcarvall@vtr.net, Antonio Alonso, Laureano Escudero, Monique Guignard, Andres Weintraub

We consider the problem of planning mine extraction under uncertainty in the price of copper. We use aggregated data from a large underground mine in Chile. We consider different price scenarios over a five year horizon, and use a stochastic integer programming approach. Lagrangean relaxation, solved via the volume algorithm, is used to handle the nonanticipativity constraints. In our computational tests, the approach compares favourably relative to a deterministic approach.

2 - Long-Term Extraction and Backfill Scheduling in a Complex Underground Mine
Donal O'Sullivan, Graduate Student, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, dosulliv@mines.edu, Alexandra Newman

We present an integer programming model to optimize the production schedule for a complex underground mining operation. The mine managers seek to maximize the amount of metal through the mill while employing a variety of mining methods to extract the ore. In addition, backfilling of mined areas is often required. The optimized long-term schedule forms the basis for a short term schedule that allows certain aspects of the operation to be considered in more detail.

3 - Optimizing Exploitation Sequences for Sublevel Caving Mines
Nelson Morales, Instituto de Innovación en Minería y Metalurgia, Avenida del Valle 738, Ciudad Empresarial Huechuraba, Santiago, Chile, NMora002@im2.codelco.cl, Maurice Queyranne, Ernesto Arancibia

Sublevel caving is done in parallel galleries, each exploited in a fixed direction. There are several galleries per level and many levels, so successively lower levels are developed as the top ones deplete. We present a model that maximizes the NPV of the exploitation sequence of a sublevel caving mine under production capacity, connectivity and subsidence constraints. We show how to reduce problem size and develop solution heuristics.

■ TC31

H-Room 503, Fifth Floor

Pricing and Choice Based Revenue Management Models in the Hospitality Industry

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Carrie Queenan, University of Notre Dame, 379 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, c_queenan@nd.edu

1 - Dynamic Versus Daily Fixed Opaque Pricing
Kristine Xie, PhD Student, The School of Hotel Administration, Cornell Univeristy, 80G Statler Hall, Ithaca, NY, 14850, United States of America, xkx2@cornell.edu, Chris Anderson

In opaque pricing certain characteristics of the service are hidden from the consumer until after purchase. We use a nested logit model in combination with logistic regression and dynamic programming to illustrate how a service firm can optimally set opaque prices. We compare optimal prices and expected revenues when dynamic pricing is restricted to daily price changes. We provide an example using data from an opaque selling mechanism (Hotwire.com) and a Washington DC based hotel.

2 - Network Price Optimization for Passenger Travel and Hospitality Industries
Pelin Pekgun, Solution Architect, OR, JDA Software Group, 1090 Northchase Pkwy, Suite 300, Marietta, GA, 30067, United States of America, pelin.pekgun@jda.com

Traditional revenue management methods offer limited insight into the dynamics of highly competitive markets, where customers have increasing visibility of prices. We describe a new approach, network price optimization, which brings competitor prices into the heart of optimization. Instead of the traditional approach of managing product availability through inventory controls, prices are directly managed based on available inventory, market reference price and the price sensitivity of customers.

3 - Integrating Choice-based Models with Capacity-based RM Routines for a Hotel
Mark Ferguson, Georgia Tech, 800 West Peachtree St, Atlanta, GA, 30308, United States of America, mark.ferguson@mgt.gatech.edu, Laurie Garrow, Melike Meterelliyoz

This paper investigates choice-based control policies for RM for multi-product industries. The addition of multiple product types complicates the choice-based RM problem. We develop several new methodologies and extensions to the single-product choice-based RM case and compare the performance of these extensions against traditional RM techniques using actual hotel industry data.

■ TC32

H-Room 504, Fifth Level

Finance

Contributed Session

Chair: Alper Corlu, Citi, 388 Greenwich, New York, United States of America, alper.corlu@citi.com

1 - An Affine Pricing and Hedging Model for European Equity Derivatives
Alexander Wugalter, Graduate Student, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, wugalter@princeton.edu, Patrick Cheridito

We consider an affine market model of a stock with stochastic volatility, stochastic interest rates and possibility of jump-to-default. This market can be made complete by taking the following four assets: stock, liquid vanilla option, a corporate and a government bond. We take an analytical approach towards pricing and hedging of European claims and propose a use of a combination of Fourier methods and direct calculation via pricing PDE.

2 - Constant Volatility Approximations for American Option Pricing in a Stochastic Volatility Model
Manisha Goswami, Research Analyst, University of Notre Dame, 370 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, mgoswam1@nd.edu, Farid AitSahlia, Suchandan Guha

In this paper we show how to adapt the numerical integral equation approach for American option pricing under the classical Black-Scholes-Merton context of constant volatility to the stochastic volatility model of Heston (1993). Our extensive numerical and empirical results demonstrate that this fast approach is also very accurate.

3 - Selling Financial Assets at the Right Time
Xun Li, Assistant Professor, Department of Applied Mathematics, Hong Kong Polytechnic University, Kowloon, Hong Kong, Hong Kong - PRC, malixun@inet.polyu.edu.hk

The process hitting the given target or early-exercise problems such as American-style derivatives is F_t-adapted. However, in real applications, particularly in dealing with selling financial assets at the right time, one usually runs into an optimal stopping time problem which is non-standard F_t-adapted. This is an interesting, but mathematically challenging, problem.

4 - A Study on the Impact of Dividends on Chinese Stocks
Xavier Pan, Associate Professor, Sun Yat-Sen University, Lingnan College, Guangzhou, China, panxpapers@gmail.com

Dividend effects have been fully studied in developed markets. However, emerging markets often have some unique features and are worth examining more. In this paper, we investigate the impact of dividend payout announcement on the stock prices and returns of companies listed in Chinese A share market. We use several ways to measure the returns and study events of dividend announcement and payment. Despite of the major similarities, interesting findings exist in the Chinese market.

5 - Analysis of the Stochastic Volatility and Jump-risk Premiums
Alper Corlu, Citi, 388 Greenwich, New York, United States of America, alper.corlu@citi.com, Yildiray Yildirim

In this study, we examine the stochastic volatility and jump-risk premiums implied by the S&P 500 index options. Model parameters were extracted using GLS. The results were compared to that of 1987 stock market crash.

■ TC33

H-Room 505, Fifth Floor

Economics Models in Supply Chains

Cluster: Economic Models in Operations Management
Invited Session

Chair: Yusen Xia, Georgia State University, Robinson College of Business, Atlanta, GA, mgtyxx@langate.gsu.edu

Co-Chair: Karthik Ramachandran, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, karthik@cox.smu.edu

1 - Impact of Low End Competition with a Strategic Supplier
Liwen Chen, PhD Candidate, The University of Texas at Austin, Department of IROM, McCombs School of Business, Austin, TX, 78703, United States of America, liwen.chen@mail.utexas.edu, Steve Gilbert, Yusen Xia

We consider how the entry of a lower quality rival affects an incumbent OEM when there are strategic suppliers. We find that if the rival's quality is intermediate, his entry can benefit the incumbent OEM. In addition, we identify the trade-off among strategic priorities that exists when the incumbent invests in capacity prior to the entry of a rival. While an aggressive investment in capacity may discourage the entry of a rival, it may also induce strategic suppliers to seek higher margins.

2 - Trade-in, Leasing, and Technology Innovation
Kate Li, Pennsylvania State University, jzl120@psu.edu, Susan Xu

Trade-in and leasing are two strategies that companies can adopt to shorten consumers' upgrade cycle and gain control over secondary markets. In this paper, we consider a monopolistic manufacturer who offers a technology product developed under a stochastic innovation process to a market consisting of heterogeneous consumers. We derive the optimal prices for the two strategies: selling with trade-in option and concurrent selling and leasing, and compare them under different scenarios.

3 - The Value of Commitments When Dealing with Strategic Customers, a Supply Chain Perspective
Ali K. Parlakturk, Assistant Professor, UNC Kenan-Flagler Business School, McColl Bldg S4708, Campus Box 3490, Chapel Hill, NC, 27599, United States of America, Ali_Parlakturk@unc.edu, Onur Kabul

We consider a supply chain composed a manufacturer and a retailer selling to forward looking customers. The customers are strategic in that they conjecture the retailer's future prices and time their purchases to maximize their utility. We solve for the optimal pricing for the manufacturer and the retailer in the face of such strategic customer behavior and evaluate the value of price and quantity commitments for the manufacturer and the retailer.

■ TC34

H-Room 520, Fifth Floor

Facility Location for Humanitarian Response

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Jessica Heier Stamm, Doctoral Candidate, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332-0205, United States of America, jheier@isye.gatech.edu

1 - Efficient Utilization of Mobile Facilities in Humanitarian Logistics
Russell Halper, Ph.D. Candidate, AMSC Program, Department of Mathematics, University of Maryland, College Park, MD, United States of America, russ@math.umd.edu, S. Raghavan

Mobile facilities can be used to efficiently provide relief when demand varies spatially and temporally. These mobile facilities could be mobile clinics, mobile communication facilities (e.g. portable cellular base stations), or mobile warehouses. The logistics problem is to determine the best strategies to route such mobile facilities to maximize the service provided. We describe a model of and heuristics for the efficient routing and utilization of mobile facilities.

2 - A Voronoi Heuristic Approach for Facility Location in Disasters
Wilfredo Yushimito, PhD Student, Rensselaer Polytechnic Institute, 110 8th Street, JEC 5107, Troy, NY, 12180, United States of America, yushiw@rpi.edu, Satish Ukkusuri, Miguel Jaller

We address the theoretical aspects of the problem of maximizing coverage of affected regions while minimizing suffering as a social cost function. We show that the social cost function is minimized at the Voronoi region enclosed around a chosen facility. A heuristic based on these diagrams is used to solve the problem.

3 - Facility Location for Foreclosed Housing Redevelopment
Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy Public Aff, McCormack Hall 3-428A, Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu, David Turcotte, Felicia Sullivan

The housing foreclosure crisis provided governments and nonprofit organizations the opportunity to purchase and rehabilitate for neighborhood revitalization. However, the cost of acquiring units for redevelopment far exceeds available funds. The current study applies best current practices in housing development to create decision models for foreclosed housing development in a large metropolitan area. We discuss modeling, implementation and policy implications of this research.

4 - Locating Humanitarian and Health Care Facilities in Systems with Self-routing Users
Jessica Heier Stamm, Doctoral Candidate, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332-0205, United States of America, jheier@isye.gatech.edu, Ozlem Ergun, Julie Swann

We study network problems motivated by humanitarian and public health scenarios. In these problems, decentralized users choose among facilities opened by a centralized planner. We present models for quantifying and improving system performance under differing individual objectives. This framework is applied to the problem of locating health clinics in Zambia that distribute HIV antiretroviral treatment. Here, decentralized decision making impacts treatment adherence and patient outcomes.

■ TC35

H-Sapphire A, Fourth Floor

Empirical Research on Health Care Operations

Sponsor: Health Applications
Sponsored Session

Chair: Anita Tucker, Assistant Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu

1 - The Impact of Manager Involvement with Process Improvement on Organizational Climate
Anita Tucker, Assistant Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu, Sara Singer

A random sample of 20 hospitals participated in an 18-month intervention to increase manager involvement in process improvement. We compared their improvement on organizational climate with 49 non-intervention hospitals. Taking action on a higher percentage of problems increased perceptions of climate while identifying problems decreased climate. Contrary to expectations, providing feedback about actions taken positively impacted managers' perceptions but negatively impacted workers.

2 - Performance Improvement of Low-volume Professional Service Work: A Multi-level Analysis
Rachna Shah, Assistant Professor, University of Minnesota, Carlson School of Management, 321, 19th Avenue South, Minnesota, MN, 55455, United States of America, shahx024@umn.edu, Susan Goldstein

Improving work done infrequently by professional service workers is challenging because volume-based learning effects cannot be utilized for process improvement. We study the effects of individual worker characteristics and organization staffing practices in community hospital emergency rooms patients when the selected diagnosis is infrequent. We find that individual professional service worker characteristics impact performance significantly and organizational staffing practices do not.

3 - Variability in Physician Ordering Practices of CTs
Jillian Berry, Doctoral Student, Harvard Business School, Wyss House, Soldiers Field, Boston, MA, 02163, United States of America, jberry@hbs.edu, Anita Tucker

This study examines the variability in physician ordering practices of head CTs in an emergency department. The time and financial effects of this variability are then analyzed.

4 - An Econometric Analysis of Patient Flows in the Cardiac ICU
Diwas KC, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, Diwas_KC@bus.emory.edu, Christian Terwiesch

This paper explores the rationing of bed capacity in a cardiac intensive care unit (ICU). We find that a patient is likely to be discharged early when the occupancy in the ICU is high. This in turn leads to an increased likelihood of the patient having to be readmitted to the ICU at a later time. We analyze the capacity implications of revisits, shedding light on the question of whether an ICU should apply an aggressive discharge strategy.

■ TC36

H-Sapphire B, Fourth Floor

Capacity Planning

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Allocation of MRI Scan Capacity in an Academic Hospital Using a Game Theoretical Approach

Maartje Zonderland, University of Twente / Leiden University Medical Center, Citadel H142, Postbox 217, Enschede, 7500 AE, Netherlands, m.e.zonderland@utwente.nl, Richard Boucherie, Judith Vink-Timmer

We develop a game theoretical model to support the allocation of MRI scan capacity among hospital departments competing over resources. Capacity is distributed according to future demands estimated by the departments. The model ensures that the departments do not provide over- or underestimations of demands, resulting in a fair allocation of capacity such that on the one hand a minimum amount of requests is rejected, and on the other hand a minimum amount of capacity is left unused.

2 - Forecasting Discharge in Patients Undergoing Neurorehabilitation

Tammy Sieminowski, University of Toronto, 580 Clinton St, Toronto, ON, M6G 2Z6, Canada, t.sieminowski@utoronto.ca

Currently, discharge dates for patients undergoing inpatient neurorehabilitation are established based on consensus professional opinion as to when a patient's functional gains are likely to plateau. Quantifying and recording functional observations routinely exchanged at multidisciplinary rounds, we established a quantitative parameter representing functional gains plateau that is associated with discharge, and developed a model that may be used to assist in forecasting discharge dates.

3 - Development and Application of a Methodology for Probability Convergence in a Healthcare System

Tze Chiam, PhD Candidate, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States of America, tzechao@purdue.edu, Yuehwern Yih

Very often there is either no true probabilities for a given system state transition, or such probabilities are unknown. A methodology developed to measure the relative entropy between probability distributions is used to determine when such probabilities are reaching convergence. As healthcare institutions often face resource shortages or overflowing demand, this methodology and the MDP are applied to a healthcare scenario to suggest appropriate actions to be taken given the system state.

■ TC37

H-Sapphire C, Fourth Floor

Flowshop Scheduling

Contributed Session

Chair: Jacques Teghem, Professor, University of Mons, Rue de Houdain,9, Mons, B-7000, Belgium, jacques.teghem@fpms.ac.be

1 - Minimizing a Quadratic Function of Job Lateness in the Stochastic Single Machine Scheduling Problem

H. M. Soroush, Associate Professor, Kuwait University, Department of Stat & Opns Res., POB 5969, Safat, 13060, Kuwait, hsoroush@kuc01.kUniversityedu.kw, F. A. Alqallaf

We study a static single machine scheduling problem in which processing times, due-dates, and penalties for not completing jobs on time are random variables. The objective is to identify an optimal sequence which minimizes the expected weighted sum of a quadratic function of job lateness. The problem is NP-hard to solve; however, we develop an exact algorithm based on a precedence relation structure among adjacent jobs. The results show that the algorithm solves large problem instances quickly.

2 - A Bi-objective Approach for Rescheduling of a Flowshop

Jacques Teghem, Professor, University of Mons, Rue de Houdain,9, Mons, B-7000, Belgium, jacques.teghem@fpms.ac.be, Daniel Tuyttens

It is necessary to integrate new jobs in a flowshop for which original jobs have been already scheduled. Two objectives are considered: a classical one(makespan, total tardiness,...) and a disruption objective(four possibilities are defined) for the original jobs. A multi-objective simulated annealing is used to approximate the set of efficient schedules. Numerical results are analyzed.

3 - Approximation of Stochastic Production Line Models of Continuous Material Flow to the Discrete Models when the System Consists of Multiple Workstations and Finite Buffers

Mohammad Quasem, Associate Professor, Howard University, Washington DC 200059, United States of America, mquasem@howard.edu

A production line is a set of subsequent operations in factory work stations where raw materials are processed to produce a product that is suitable for consumption or produce components that are assembled to make an end product. Inefficiency in a production line becomes a factor when workstations are starved or blocked; as a remedy buffers are used to ensure that the workstations are not blocked or starved. The installation of the buffer increases efficiency. In a production line if the work pieces are discrete where the service time at each station is constant and the same, then the number of possible system states increase rapidly with buffer capacities. In this circumstance, it is cumbersome to find the steady-state probabilities as the buffer capacity increases. In this study a method will be developed so that discrete production line models can be approximated by the continuous production line model. This approximation model will be used to measure the productivity improvement of the manufacturing system.

■ TC38

H-Sapphire D, Fourth Floor

Inventory Management and Applications

Cluster: Inventory Management
Invited Session

Chair: Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heighs, United States of America, yingdong@us.ibm.com

1 - Project-Driven Supply Chains (PDSCs): Integrating Inventory Planning with Project Management

Yao Zhao, Associate Professor, Rutgers University, 180 University Ave, Newark, United States of America, yaozhao@andromeda.rutgers.edu

We consider strategic planning of recurrent capital projects and their material supplies over an extended period of time. Rather than the traditional project-based approach (managing each project separately) or the recent supply-based approach (leveraging the need of multiple projects on a continuing basis), we develop an integrated approach — PDSC — to integrate supply chain lead time/safety stock planning with project management.

2 - Partially Observed Lost Sales (POLS)

Metin Cakanyildirim, University of Texas at Dallas, Dallas, TX, metin@utdallas.edu, Annabelle Feng, Alain Bensoussan, Suresh Sethi

Inventory literature traditionally assumed that lost sales were completely observed. Some recent models have unobserved lost sales. These two situations are extremes. The reality often lies in between where the lost sales are partially observed. We discuss partially observed lost sales (POLS) in practice and build a model taking POLS data into account.

3 - Demand Shaping through Bundling: A Dynamic Multiproduct Inventory-Pricing Model

Zhengliang Xue, IBM T.J.Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, zxue@us.ibm.com, Jeannette Song

We analyze the optimal joint inventory, pricing, and bundling decisions for a firm over a finite horizon. A product can be either a single component or a package of several components. We show the component complementariness, cost structure, inventory status, demand randomness and supply responsiveness drive the bundling strategy. We provide insights into when to change the bundling strategies, based on the ratio of the cost gap to the quality gap among the vertically differentiated products.

4 - Joint Inventory and Pricing Decisions for Multiple Item Inventory Products and Multiple Sales Chanel

Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heighs, United States of America, yingdong@us.ibm.com

We consider an optimization problem for joint inventory and pricing decisions for a multi-item inventory system with multiple sales channels. Both structural and numerical properties of the problems are discussed.

■ TC39

H-Sapphire E, Fourth Floor

Procurement and Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

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

1 - Supply Chain Coordination for Perishable Goods with Two Periods of Shelf Life

Feryal Erhun, Assistant Professor, Stanford University, Terman Enineering Center, Room 305, Stanford, CA, 94305, United States of America, ferhun@stanford.edu, Yenho (Thomas) Chung

A manufacturer of a perishable item with two period shelf life designs contracts to sell old units along with young ones. We study three different contracts: a two-level wholesale price contract, a two-level buy-back contract, and a buy-back contract with channel rebates on old units. We demonstrate channel coordinating conditions under each of these contracts.

2 - Strategic Price Quotation by a Tier-two supplier

Bin Hu, Doctoral Candidate, University of Michigan, Ross School of Business, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, hub@umich.edu, Damian Beil, Izak Duenyas

We study price quotation decisions made by a tier-two supplier. The supplier's two potential customers compete in a reverse auction for an OEM's contract, and use the supplier's price quote as a cost input when determining their price bid. By quoting higher prices the supplier increases its potential profits but reduces the chance that either customer can meet the OEM's reserve price. We characterize the supplier's optimal pricing decisions.

3 - Supplier Quality and Relationships under Competition

Anupam Agrawal, University of Illinois at Urbana-Champaign, Champaign, IL, 61820, anupam@illinois.edu

We explore buyer supplier relationships in competitive scenarios, and study conditions under which suppliers price the same components differently to different buyers. We also study how buyers can affect this choice, and explore these conditions in the light of our empirical research in the automotive industry

4 - Optimal Ordering Under Lead Time Uncertainty and Forecast Updating

Yimin Wang, Assistant Professor, Arizona State University, Dept. of Supply Chain Management, P. O. Box 874706, Tempe, AZ, 85287, United States of America, Yimin_wang@asu.edu, Brian Tomlin

We consider a firm's procurement problem when facing lead time uncertainty and a dynamic forecasting process. Using a discrete time MDP approach, we characterize the firm's optimal procurement policy. We prove that, with multiplicative forecast revisions, the firm's optimal procurement time is independent of the demand forecast evolutionbut that the optimal procurement quantity is not. This leads to a number of important managerial insights into the firm's planning process.

■ TC40

H-Sapphire H, Fourth Floor

Scheduling, Learning and Workforce Management in a Production Environment

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Thomas Vossen, University of Colorado, 955 Regent Drive, Boulder, CO, 80309, United States of America, vossen@colorado.edu

1 - Production Scheduling and Pricing in Dynamic Stochastic Cutting Stock Applications

Harald Reinertsen, Leeds School of Business, University of Colorado at Boulder, Boulder, United States of America, Harald.Reinertsen@Colorado.EDU, Thomas Vossen

Dynamic industrial cutting stock problems give rise to new production scheduling strategies that allow large reductions in production cost. Due to the special structure of the scheduling problem, postponement and order selection strategies together with future demand approximations reduce scrap considerably while also improving due date performance. We discuss how order attributes affect production cost and offer new insights into pricing based on these attributes and the state of the system.

2 - The Effect of Learning on Manufacturing Outsourcing Decisions: A Game Theoretic Approach

Wenli Xiao, Georgia Institute of Technology, 800 W. Peachtree St. NW, Atlanta, GA, 30308-0520, United States of America, Xiao.Wenli@mgt.gatech.edu, Cheryl Gaimon

In a two-period game, a buyer determines the portion of demand to manufacture in-house versus outsource; the supplier determines the price. The supplier realizes learning from all customers. The buyer realizes learning in manufacturing and outsourcing integration cost. Also, learning enhances the buyer's revenue by improving product quality. We show how the supplier's price (buyer's outsourcing decision) is impacted by its own learning and the buyer's (supplier's) learning.

3 - Dynamic Worker Allocation in Order Fulfillment Systems

Kevin Gue, Associate Professor, Auburn University, Department of Industrial and Systems Eng, Auburn, AL, 36849, United States of America, kevin.gue@auburn.edu, Hyun Ho Kim

We describe dynamic worker allocation rules for an order fulfillment system (in most cases, a distribution center) that works against a firm, daily deadline. Success is measured by the percentage of orders arriving before a cut-off time that are finished before the deadline. We compare two rules: one based on sojourn time distributions, which we show how to compute, and a second based a simple rule of thumb.

■ TC41

H-Sapphire L, Fourth Floor

Working with Non-profit Organizations

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Louis Luangkesorn, Visiting Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu

1 - Food Banks Can Improve Their Operations with OR Tools: A Pilot Study on Pittsburgh Food Bank

Canan Gunes, Ph.D. student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, cgunes@andrew.cmu.edu, Willem-Jan van Hoeve, Sridhar Tayur

In this study we work closely with Pittsburgh Community Food Bank (GPCFB) to improve their operations. We particularly focus on GPCFB's VRP, which has not been studied before, and evaluate three different approaches to solve this problem: MIP-based column generation, exact CP-based model and heuristic CP-based model. Our computational results indicate that the heuristic CP-based model can yield substantial savings even when a small number of changes (locations) are considered.

2 - Supply Chain Optimization for the World Food Program

James Wade, Student, Georgia Institute of Technology, 400 17th St. NW #2409, Atlanta, GA, 30363, United States of America, j.wade@gatech.edu, Lawrence Li, Elhadj Bah, Manuel Jimenez, Ozlem Ergun, Santiago Aviles, Alvaro Morales

We will discuss our work with WFP, food aid arm of the United Nations, to improve supply chain performance in ongoing (non-emergency) operations. An inventory-ordering tool was created to help standardize inventory policies and aid in decision-making. The team also built an optimization model of the global supply chain network to investigate the effects of proposed strategic changes such as pre-positioning. Preliminary results have predicted savings and increases in service levels.

3 - Determining Resource Requirements and Staging Areas for Food Distribution in Disaster Response

Louis Luangkesorn, Visiting Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu

In 2008, the American Red Cross responded to a series of disasters across the southern United States. As operations for each event scaled up and down, resources were redeployed from operation to operation. The use of OR logistical models in disaster response is hampered by lack of available data. This work will develop a model that can estimate resource requirements and site staging locations using data that would be available during a disaster response.

■ TC42

H-Sapphire P, Fourth Floor

Sourcing in SCM

Contributed Session

Chair: Linlin Li, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, linlinli2008@u.northwestern.edu

1 - The Trade-off of Quality Improvement in a Channel with Advertising- and Quality-based Goodwill

Pietro De Giovanni, PhD Candidate, Essec Business School, Avenue Bernard Hirsch, Cergy Pontoise Paris, 95801, France, pietro.degiovanni@essec.fr

We consider a distribution channel with a single manufacturer and a single retailer where the demand depends negatively on price and positively on goodwill. The manufacturer invests in quality improvement to build up the goodwill. However, improving quality increases the production cost, thus the manufacturer faces the trade-off increasing goodwill and increasing cost. We address the question whether cooperation is beneficial for both players when such a trade-off occurs.

2 - Outsourcing to Suppliers Who Might Subcontract
Hubert Pun, Indiana University, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, hpun@indiana.edu, Hans Sebastian Heese

Firms need to take into consideration their suppliers' incentives to subcontract part of their workload. We consider a project that consists of two tasks with uncertain and potentially correlated output qualities. A manufacturer contracts with a generalist, who can perform both tasks in-house or subcontract one task with a specialist. We analyze the generalist's subcontracting incentives and its impact on the manufacturer's optimal payment, project quality and firm profitability.

3 - Analysis of Outsourcing Business Functions in Various Industries
Ramesh Bollapragada, Associate Professor, College of Business, SFSU, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu, Zeynep Yalin, Chetty Bingi, Udayabhanu Vaidyanathan

In this paper, we study the differences on the benefits, challenges risks (both current and future) of outsourcing business functions such as Manufacturing, IT, Logistics and CRM services. Results from the survey sent to 148 executives in U.S.A. at CEO, CTO, COO levels with a 42% response rate, is presented. The survey analysis allows managers to evaluate the benefits, challenges, risks and the service provider selection criteria based on the outsourced function.

4 - Transfer Strategies in the Capacity Reservation Problem
Linlin Li, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, linlinli2008@u.northwestern.edu, Seyed Iravani, Izak Duenyas

This paper considers situations where firms buy options to use the capacity of suppliers. We explore whether suppliers should provide options such that a firm that can not use all the capacity can sell it to another firm that may need the capacity. We compare three policies for the manufacturer to deal with one buyer's unused capacity and another's unfulfilled demand, and provide managerial insights into when it is optimal for the supplier to allow transfer rights with the capacity options.

■ TC43

H-Room 400, Fourth Floor

Managing Commodity Risk in Supply Chain

Cluster: Supply Chain Models
Invited Session

Chair: Lingxiu Dong, Washington University in St. Louis, Olin Business School, 1 Brookings Drive, St. Louis, MO, 63130-4899, United States of America, dong@wustl.edu

Co-Chair: Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu

1 - Optimal Managerial Compensation and Financial Hedging in Commodity Procurement
Masha Shunko, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, mshunko@andrew.cmu.edu, Nicola Secomandi, Laurens Debo, Lin Nan

Consider a firm that uses a traded commodity as input to its production process and employs a risk-averse procurement manager. We study the interaction between the firm's financial hedging policy and the manager's procurement policy, the manager's optimal compensation structure, and the sensitivity of this structure to relevant parameters. We find that the optimal bonus for the manager is nonmonotone in various parameters of interest and only medium size firms benefit from financial hedging.

2 - Capacity Management for Agricultural Commodities
Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

This paper analyzes the capacity investment portfolio of a processor that uses a single input to produce multiple products in fixed proportions. The input and each output production require dedicated capacities. The main motivation comes from agribusiness where the input and some of the outputs are commodities and are traded on the spot markets. We investigate the effect of spot price variability, correlation among different end-products on the optimal capacity investment portfolio.

3 - Effect of Term Structure of Futures Price on Spot Procurement Policies
Ankur Goel, Case Western Reserve University, ankur.goel2@case.edu, Genaro Gutierrez

In this research, we explore the effect of term structure information of futures prices on the procurement policies from the spot market. We compare one-factor stochastic price model with a two-factor model to quantify the benefits of higher term structure model on operating policies. We conclude that for gasoline the two factor price model leads to substantial inventory cost savings. In addition, the frequent calibration of the price process has marginal benefit.

4 - Value of Processing Flexibility in Uncertain Input and Output Markets
Xiaole Wu, Ph.D. Candidate, Olin Business School, One Brookings Drive, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Lingxiu Dong, Panos Kouvelis

We consider a processing plant that takes in commodity inputs at various quality levels and processes them into intermediates that will be blended into various outputs. We focus on a specific type of processing flexibility that is used in the oil refinery industry, that is, converting low quality intermediates to high quality ones. We examine the value of such operational flexibility in an environment where input and output prices are volatile.

■ TC44

H-Room 402, Fourth Floor

Advanced Modeling Methods for Health and other Services

Sponsor: Service Science
Sponsored Session

Chair: Kalyan Pasupathy, Assistant Professor, University of Missouri, CE732 CS&E Building, Five Hospital Drive, Columbia, MO, 65212, United States of America, pasupathyk@missouri.edu

1 - Streamlining Patient Flow in Surgical Services
Mustafa Sir, Assistant Professor, University of Missouri, Industrial and Manufacturing Systems Eng, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, sirm@missouri.edu, Kalyan Pasupathy, Luis Occena, Rung-Chuan Lin, Eric Miedema

Hospital management often puts pressure on the surgery department to increase patient throughput. However, management often fails to consider the effect of capacity of pre- and post-surgical resources. Instead of solely focusing on the efficiency of operating rooms, we view the entire surgical services as a large system from admission to discharge. Our model provides valuable insights into resource allocation across different stages of the surgery process and its effect on the throughput.

2 - Simulation and Network Modeling of Hospital Pharmacy Delivery
Beilei Zhang, University of Missouri, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America bztdd@missouri.edu, Kalyan Pasupathy

This project aims at optimizing internal pharmacy delivery by using a hybrid modeling approach combining simulation and network modeling. The simulation modeling is used to build stochastic scenarios of the operations within inpatient pharmacy and measure performance, while the mathematical model defines the delivery network of the various units. By comparing different scenarios, the most suitable networking strategy can be identified.

■ TC45

H-Room 410, Fouth Floor

New Product Development I

Contributed Session

Chair: Sidharth Rupani, PhD Candidate, MIT, 550 Memorial Drive, Apt. 23B4, Cambridge, MA, 02139, United States of America, sidrup@mit.edu

1 - Aligning Sources of External Knowledge in New Product Development with Choice of Generic Strategy
Fabrizio Salvador, Professor, Instituto de Empresa, C/Maria de Molina 11, Madrid, 28006, Spain, Fabrizio.Salvador@ie.edu, Anil Akpinar

In NPD literature, it has been already acknowledged that firms should acquire knowledge from external sources to complement their internal knowledge. In this paper we explore the role of generic strategies in deciding which external sources to use for a superior innovation performance. We hypothesize and provide empirical evidence that under differentiation strategy customer involvement will result in superior innovation performance whereas cost leadership benefits from supplier involvement.

2 - Alternative Supply Chain Management Strategies for New Product Diffusion: An ABMS Approach
Mohammad Amini, The University of Memphis, 365 Innovation Drive, Memphis, United States of America, mamini@memphis.edu, Tina Wakolbinger, Mike Racer, Mohammad Nejad

In this paper, we develop an agent-based model to simulate the effect of alternative supply chain strategies on the diffusion process of a new product. The potential demand market consists of 3,000 customers interconnected through their social network. The diffusion process is driven by positive and negative word-of-mouth, marketing efforts, and capacity restrictions. Using extensive computational experimental design, we compare the NPV of profit generated by alternative strategies.

3 - Alliance Depth, Success and Strategic Orientation of the Firm: Evidence From the Biotech Industry
Manpreet Hora, Assistant Professor, Georgia Institute of Technology, 800 W Peachtree St. NW, Atlanta, GA, 30328, United States of America, manpreet.hora@mgt.gatech.edu, Devkamal Dutta

We study the role alliance partnerships between biotech entrepreneurial firms and mainstream drug companies play in ensuring entrepreneurial success through the product development life-cycle for introduction of new drugs. Examining over 1000 alliances in the US biotech industry spanning a five-year period (2004-2008), we investigate the relationship between alliance depth, success, and the biotech firm's strategic orientation.

4 - The Soft Resource Allocation Problem
Foad Iravani, UCLA Anderson School of Management, 110 Westwood Plaza, Suite B512, Box 951481, Los Angeles, CA, 90095-1481, United States of America, foad.iravani.2012@anderson.ucla.edu, Reza Ahmadi, Sriram Dasu

We propose a hierarchical framework for organizing and staffing a product development process at a leading software company that produces tax software. Every year, the firm struggles with a high workload imposed by thousands of changes in tax rules announced by the IRS. These changes have to be processed and incorporated into the next generation of the product by mid-December. We develop models for organizing and staffing the development activities to meet the deadline at the lowest cost.

5 - Product Development Process Standardization in Multi-Project Organizations
Sidharth Rupani, PhD Candidate, MIT, 550 Memorial Drive, Apt. 23B4, Cambridge, MA, 02139, United States of America, sidrup@mit.edu

The overarching question of this paper is 'what is the right level of variation across product development processes in a multi-project organization?' Process standardization offers learning and efficiency benefits, but process diversity could allow widely varying projects to effectively meet project targets of cost, schedule, and quality. This paper builds on a broad survey of the literature and detailed company case studies to lay out a framework to manage this tradeoff.

■ TC46

H-Room 411, Fourth Floor

KLIC II

Sponsor: Technology Management
Sponsored Session

Chair: Nile Hatch, Brigham Young University, Marriott School, 690 TNRB, Provo, UT, 84602, United States of America, nile@byu.edu

1 - The Persistence of Organizational Knowledge across Merger and Acquisition Events
Peter Madsen, Assistant Professor, Brigham Young University, 585 TNRB, Provo, UT, 84602, United States of America, petermadsen@byu.edu

The ability to gain access to new organizational knowledge is a frequently noted justification for corporate mergers and acquisitions. However, there is good reason to expect that much organizational knowledge may be lost during merger and acquisition events. In this paper, I examine the persistence of previously acquired organizational knowledge across mergers and acquisitions in the U.S. airline industry.

2 - The Pharma/Biotech Innovation Conundrum: R & D Spending Up, No. of Drugs Down
Tom Hill, Principal, The Leverage Innovation Group, 1677 Honfleur Drive, Sunnyvale, CA, 94087, United States of America, thill@leverageinnovation.com

This paper identifies the challenge facing the healthcare industry in terms of research and development productivity. While the industry has doubled spending in R & D in the past 9 years, the number of drugs actually approved has dropped in half. The paper identifies strategic issues that contribute to this lack of productivity, and the role that innovation pathways play toward a solution.

3 - Social Network Ties, Transactive Memory, and Performance in Groups
Kyle Lewis, Associate Professor, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, kyle.lewis@mccombs.utexas.edu, Jeong-Yeon Lee, Daniel Bachrach

We use transactive memory systems (TMS) theory to explain what drives the effects of certain social network structures in small groups. We examine the combined effects of reciprocity and the number of 'axis' members and TMS on team performance. We find that different network structures differentially affect TMSs and performance. The implications of the results from this experiment for theory, as well as practice are developed.

4 - Information Velocity and Competitive Advanatage
Nile Hatch, Brigham Young University, Marriott School, 690 TNRB, Provo, UT, 84602, United States of America, nile@byu.edu, Michael Miles, Ryan Williams, Alex Cavallini

Information velocity is the ability to respond correctly to uncertain market demand. Manufacturers that transform information into offerings faster than rivals earn competitive advantages through lower costs, growing revenues, and price premia. We find that lean manufacturers have greater information velocity and enjoy 2.5 times greater returns than non-lean firms with lower information velocity. This result is strengthened in markets with high demand volatility.

■ TC47

H-Room 412, Fourth Floor

Outsourcing Governance, Capabilities, and Outcomes

Cluster: Global Sourcing of Services
Invited Session

Chair: Rajiv Kishore, SUNY at Buffalo, School of Management, Buffalo, NY, 14260, United States of America, rkishore@buffalo.edu

1 - Rewards and Penalties in IT Outsourcing: When are They Used and do They Work as Intended?
Rajiv Kishore, SUNY at Buffalo, School of Management, Buffalo, NY, 14260, United States of America, rkishore@buffalo.edu, Matthew Swinarski

Recent studies have shown that the contract itself as well as past vendor performance have an impact on trust and relational governance in contractual relationships. We extend this literature by studying the impact of exercise of rewards and penalties (that may or may not be specified in the contract) on trust and relational governance.

2 - The Effects of Relationship, Governance, Knowledge Factors on IS Outsourcing Effectiveness
Balaji Sankaranarayanan, Bentley University, 175 Forest street, Waltham, United States of America, bsankara@bentley.edu

Applying RBV of strategic relationships and organizational learning theories, this research develops and tests hypotheses based on a research model of relationship, governance, and learning factors, and their impacts on application development outsourcing effectiveness, from the client perspective. A field survey of client-side IS managers was conducted to test the hypotheses using PLS. The results of this study have prescriptive value for academics and practitioners alike.

3 - Modular Architecture, Task Disaggregation and Incentives in 'Software as a Service'
Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu, Anitesh Barua

A key challenge in service disaggregation is knowledge interdependencies across client and provider organizations that results in a multitask agency problem involving the lack of verifiability of certain tasks. Our key research questions involve (i) the suitability of incentives in contracts when the outsourced task has multiple dimensions or facets that differ in verifiability, and (ii) how such contract choice is affected by the modularity of interfaces between the client and the provider.

■ TC48

H-Sapphire Green Room, Fourth

Advances in Teaching Service & Retail Operations

Cluster: Service Operations Management
Invited Session

Chair: Nicole DeHoratius, University of Portland Pamplin School of Business, Zaragoza Logistics Center, Portland, United States of America, dehorati@up.edu

Co-Chair: Zeynep Aksin, Koc University, Istanbul, Turkey, zaksin@ku.edu.tr

1 - Teaching Global Dual Sourcing: Mexico-China Game
Jan Van Mieghem, Professor, Kellogg-Northwestern University, MEDS dept, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, vanmieghem@kellogg.northwestern.edu, Gad Allon

We consider a firm with access to a responsive local source and a cheap but remote source. The firm must determine a sourcing strategy to satisfy random demand over time. To transfer recent academic insights to the classroom, we present a game where student teams place orders to both sources over time and manage inventory and their bank account. We analyze the student policies along both financial and operational metrics, present the optimal strategy, and summarize the learning points.

2 - "Innovience" - The Integration of Innovation & Science
Mike Cramer, Director, Operations Research, McDonald's Corporation, 1253 North Schmidt Road, Romeoville, IL, 60446, United States of America, mike.cramer@us.mcd.com

The McDonald's Innovation Center tackles Global Business Issues on a daily basis. With over 2,000 customers per year, there needs to be a way to connect, be predictive & influence thinking to accelerate the decision making process. This talk will be centered around the new concept of "Innovience" which is the integration of innovation & science to accelerate the process of reaching concensus and aligned decision making.

3 - Should You Teach a Service Operations Class?
Don Eisenstein, Professor, University of Chicago, Booth School of Business, 5807 So Woodlawn Ave, Chicago, IL, 60637, United States of America, Don.Eisenstein@chicagobooth.edu

Typically, the topics covered in a service operations class is a subset of a core operations class. I will discuss why I think this is a mistake, and illustrate with a small case I wrote. I will also discuss my experiences in general in developing a service operations course.

4 - Teaching Service Operations to Service-oriented Undergraduate Students
Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

Cornell's School of Hotel Administration offers a unique undergraduate program which blends business education with the specific needs of hospitality and service industry. The students of this program are extremely bright and very aware of the needs and demands of a service-based organization. While exciting, this environment presents unique challenges to the instructor. We will discuss some of the lessons learnt in teaching in this program during the last few years.

■ TC49

H-Room 300, Third Floor

Supply Chain Decisions to Manage Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Kathryn Stecke, Ashbel Smith Professor, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, kstecke@utdallas.edu

1 - The Effect of Stochastic Dependency in Supply Disruptions on Supply Chain Performances
Behdad Masihtehrani, PhD Student, Penn State University, Department of Industrial Engineering, University Park, PA, 16802, United States of America, behdad@psu.edu, Soundar Kumara, Susan Xu

We consider how stochastic dependency in supply disruptions affects supply chain performances. We show that while positive stochastic dependency in supply disruptions has adverse effects on the cost and fill rate of a multi-source supply chain, it has favorable effects on these measures in an assembly supply chain. We discuss how such stochastic dependency affects retailers' inventory policies in these two network settings.

2 - Coordinating Supplies and Infrastructure for Disaster Relief
Amiya Chakravarty, Northeastern University, 360 Huntington Ave, Boston, United States of America, A.Chakravarty@neu.edu

We study a hybrid strategy combining proactive and reactive decisions. The relief provider decides relief quantity to purchase from the retailer who determines the price, and sets up a contract for infrastructures services by specifying a repair delay he would be willing to tolerate; the service provider determines the amount of incentive-subsidy she would require for upgrading the infrastructure.

3 - Sustainable Container Transport by Disruption Management
Rob Zuidwijk, Associate Professor, Rotterdam School of Management, Erasmus University, P.O. Box 1738, Rotterdam, 3062 PA, Netherlands, rzuidwijk@rsm.nl, Albert Veenstra, Jan van Dalen

Based on our findings from a large project with industry, we aim to quantify how container transport can be made more secure, efficient, and environmentally friendly. By means of a model, we study how data captured in the supply chain and response measures create opportunities to make better trade-offs between these objectives. We also pay attention to some of the implementation issues in a real life setting.

■ TC50

H-Room 302, Third Floor

Managing Service Systems: Some Insights on Scheduling, Capacity Planning and Pricing

Sponsor: MSOM/ Service Management
Sponsored Session

Chair: Ramandeep Randhawa, University of Sourthern California, Los Angeles, CA, United States of America, Ramandeep.Randhawa@mccombs.utexas.edu

1 - Modeling Abandonment From an Emergency Department
Ehsan Bolandifar, Washington University in St. Louis, 1 Brookings Dr., St. Louis, MO, 63130, United States of America, bolandifar@wustl.edu, Tava Olsen

We address modeling and analysis of patient abandonments due to excessive delays from an emergency department. While addressing certain data-related issues caused by censored sampling, we model our problem as an M/G/n system with abandonment in order to evaluate investment in decreasing patient boarding caused by the main hospital.

2 - When the c\mu Rule is not Optimal
Amy Ward, USC, Marshall School of Business, BRI401H, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu

We consider the problem of how to dynamically schedule waiting customers for service in a single server queue with multiple impatient customer classes. Each customer class is willing to pay a specified amount for his service, but will abandon the queue without paying if he is not served within a generally distributed amount of time. We show that a threshold-type, non-greedy policy is nearly optimal for a system in which the server is heavily utilized.

3 - Services Cloud Pricing: Dynamic Pricing of Computing Resources for a Reservation System
Denis Saure, Columbia University, 3022 Broadway, Uris Hall, 4N, New York, NY, 10025, United States of America, dsaure05@gsb.columbia.edu, Hani Jamjoom, Assaf Zeevi, Anshul Sheopuri, Huiming Qu

We study a reservation system for computing resources over a finite horizon, where users submit reservation requests in advance. Each user is allocated a limited number of tokens which can be exchanged for computing time. The objective is to maximize system performance by (dynamically) adjusting token prices per unit of computing time. We propose pricing policies that smooth demand over the horizon, and discuss its implementation in a "Cloud" for high performance computing being developed by IBM

■ TC51

H-Room 303, Third Floor

Computational Linear and Integer Programming

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Yan Xu, Analytical Solutions Manager, SAS Institute Inc., SAS Campus Drive, Cary, United States of America, Yan.Xu@sas.com

1 - Microsoft Solver Foundation

John Oberon, Director of Program Management, One Microsoft Way, 4/2194, Redmond, WA, 98052-6399, United States of America, John.Oberon@Microsoft.com

Solver Foundation is a pure, managed code runtime for mathematical programming, modeling, and optimization. This .NET/CLR based framework provides a rich set of tools, services, and engines. We will focus on our computational integer programming effort - a branch and cut solver based on Dual Simplex, and is designed to enable 64-bit and multi-core computation environments. We will discuss advanced presolve, Gomory mixed integer cuts, mixed integer rounding cuts, and local search heuristics.

2 - Solving Linear Optimization Problems with MOSEK

Bo Jensen, MOSEK ApS, C/O Symbion Science park Fruebjergevj 3, Copenhagen, Denmark, bo.jensen@mosek.com

The software package MOSEK is capable of solving large-scale sparse linear optimization problems using either an interior-point, a primal simplex or a dual simplex algorithm. The aim of this talk is to present the linear optimizers and the recent advances in their implementation. Moreover, we will present numerical results demonstrating the optimizers performance.

3 - Cutting Planes in SAS MILP Solver

Amar Narisetty, SAS Institute, SAS Campus Drive, Cary, United States of America, Amar.Narisetty@sas.com, Yan Xu

The SAS MILP solver implements a branch-and-cut algorithm for solving large scale mixed integer linear programs. In this talk, we give an overview of the families of cutting planes currently incorporated in the SAS MILP solver. These include, GMIC, MIR, Covers, Cliques, etc. We present computation results to demonstrate the effectiveness and contribution of each family of cutting planes in solving some well known instances.

4 - IBM ILOG CPLEX Technology Update

John Gregory, ILOG CPLEX Product Manager, IBM ILOG Optimization, 889 Alder, Suite 200, Incline Village, NV, 89451, United States of America, jgregor@us.ibm.com

This talk will highlight the recent major enhancements in IBM ILOG CPLEX, covering both solution speed and usability features. Details on MIP benchmarking results will be provided. The latest information about the integration of ILOG and its products into the greater IBM optimization community will also be shared.

■ TC52

H-Room 304, Third Floor

Supply Chain Competition and Coordination

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Tieming Liu, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74074, United States of America, tieming.liu@okstate.edu

Co-Chair: Biying Shou, City University of Hong Kong, Tat Chee Ave., Kowloon, Hong Kong - ROC, biying.shou@cityu.edu.hk

1 - Duopoly Competition on Prices and Customer Acquisition

Xiaona Zheng, Peking University, Guanghua School of Management, Peking University, Beijing, 100871, China, xzheng@gsm.pku.edu.cn, Xiting Gong

In this paper, we study a duopoly model where two firms compete on prices and customer acquisition investment. We consider factors such as market concentration and product differentiation. We find mixed results for the equilibrium structures and show that two firms engaging in customer acquisition competition may encounter the prisoner's dilemma.

2 - Sales Effort Free Riding and Coordination with Price Match and Selective Compensation Rebate

Dahai Xing, Oklahoma State University, 502 Engineering North, Stillwater, 74078, United States of America, dahai.xing@okstate.edu, Tieming Liu

This paper studies sales effort coordination for a supply chain with one manufacturer and two retail channels, where an online retailer offers a lower price and free-rides a traditional retailer's sales efforts. We designed a contract with price match and selective compensation rebate. The numerical analysis shows that such a contract can achieve a supply chain efficiency approximating that of an integrated supply chain.

3 - Product Information Free Riding between On-line Retailers and Coordination with Reward-per-Click

Tieming Liu, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74074, United States of America, tieming.liu@okstate.edu, Xianjun Geng

We study a supply chain setting with one manufacturer and two on-line retailers. One retailer free-rides the product information (e.g. product specifications and customer reviews) provided on the other retailer's website. Providing the product information is costly for on-line retailers, and thus the free-riding hurts the supply chain performance. We investigate how a reward-per-click contract offered by the manufacturer coordinates the supply chain.

4 - Managing Supply Uncertainty of Wireless Network

Biying Shou, City University of Hong Kong, Tat Chee Ave., Kowloon, Hong Kong - ROC, biying.shou@cityu.edu.hk, Jianwei Huang, Lingjie Duan

We study a three-tier wireless supply network model consisting of a spectrum holder, a wireless network operator, and a set of end-users. The network operator obtains its capacity by leasing or sensing spectrum from the spectrum holder, and then sells it to the end-uers. Due to the nature of cognitive spectrum sensing, the capacity outcome is unreliable. We establish a decision model and derive the optimal capacity investment and user-pricing decisions at the equilibrium.

■ TC53

H-Room 305, Third Floor

New Integer Programming Applications

Sponsor: Optimization/Integer Programming
Sponsored Session

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

1 - Color Codes and Integer Programming for Fault-tolerant Quantum Computation

Jonas Anderson, University of New Mexico, 800 Yale Blvd NE Albuquerque, Albuquerque, NM, 87131-0001, United States of America, jander10@unm.edu, Andrew Landahl

In a quantum computer, physical quantum bits (qubits) interact with the environment, requiring constant error correction. In Topological color codes (TCCs) a logical qubit is encoded in many noisy physical qubits which are measured by local parity checks. Given the parity data, we use an integer program (IP) to diagnose the most likely set of errors. We simulate error patterns with Monte Carlo experiments and find a threshold for quantum computing with TCCs.

2 - Deterministic Integer-Programming Methods for Generating Graphs with Specific Properties

Vitus Leung, Senior member of technical staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, vjleung@sandia.gov, Randall Laviolette, Cynthia Phillips, Robert Carr

Our presentation is on a graph generation problem motivated by Li et al's model for the structure of some infrastructure networks. Those who study link prediction, for example, would like to generate graphs with such structure, or closely related. The integer program for this problem is straightforward except for the exponential number of constraints required to enforce that the graph is connected. However, there exists a deterministic separation algorithm to enforce graph connectivity.

3 - Moving Multiple Sinks to Maximize the Lifetime of Wireless Sensor Networks

Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov, Stefano Basagni, Alessio Carosi, Chiara Petrioli

We consider scheduling mobile data-collecting sinks in wireless networks. Sensors close to sinks expend more energy relaying messages than those far away. Sinks move to distribute load. We give a linear program that provides an upper bound on the lifetime of a network with constant data rates. We solve this LP using p-median integer programs as separators and compute a heuristic schedule from the LP solution that is within 1.4% of the upper bound for networks with hundreds of sensors.

■ TC54

H-Room 306A, Third Floor

Computing Equilibrium in Markets and Games

Sponsor: Optimization/Networks
Sponsored Session

Chair: Nikhil Devanur, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States of America, nikdev@microsoft.com

1 - Proportional Response Dynamics in the Fisher Market
Li Zhang, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, lzha@microsoft.com

We show that the proportional response dynamics converges to the market equilibrium in the Fisher market with constant elasticity of substitution (CES) utility functions. By the proportional response dynamics, each buyer allocates his budget proportional to the utility he receives from each good in the previous time period. Despite its simplicity, the dynamics converges fast for strictly concave CES utility functions, matching the bound via solving a global convex optimization problem.

2 - Fisher Markets with Transportation Costs
Chinmay Karande, PhD Student, Georgia Institute of Technology, 15046 SE 14'th St., Bellevue, WA, 98007, United States of America, ckarande@gmail.com, Sourav Chakraborty, Nikhil Devanur

We consider a natural generalization of the Fisher market model where buyers pay a transportation cost on each unit of good bought, depending upon the seller's location. The transportation costs can also be interpreted as the buyer's preferences expressed in an additive sense. We provide the proof of existence of market clearing prices in this model, as well as an algorithm to compute an \epsilon-approximate equilibrium.

3 - Settling the Complexity of Market Equilibria
Shanghua Teng, Boston University, 111 Cummington St, Boston, MA, 02215, United States of America, shanghua.teng@gmail.com

We prove that the problem of computing an Arrow-Debreu market equilibrium is PPAD-complete even when all traders use additively separable, piecewise-linear and concave utility functions. I will also discussion about the extension of this result to Fisher equilibria. Joint work with Xi Chen, Decheng Dai, and Ye Du.

4 - Convergence of Local Dynamics to Balanced Outcomes in Exchange Networks
L. Elisa Celis, University of Washington, U. of Washington, Computer Science, Box 352350, Seattle, WA, 98195, United States of America, ecelis21@gmail.com, Yossi Azar, Benjamin Birnbaum, Nikhil Devanur, Yuval Peres

Bargaining games on exchange networks have been extensively studied. A Balanced Outcome for such a game is an equilibrium concept that combines notions of stability and fairness. Recent work gave a polynomial time global algorithm to compute such outcomes. However, it left a pertinent open question: "are there natural, local dynamics that converge to a balanced outcome?" We answer in the affirmative by describing a process and showing it converges to a balanced outcome whenever one exists.

■ TC55

H-Room 306B, Third Floor

Traveling Salesman Problems

Contributed Session

Chair: Vladimir Bugera, Kammerdiner Consulting, 16031 N 31st AVE, Phoenix, AZ, 85053, United States of America, vladimir@bugera.com

1 - The Circuit Polytope
John Hooker, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, john@hooker.tepper.cmu.edu, Latife Genc-Kaya

The circuit constraint provides a very succinct formulation of the traveling salesman problem and other sequencing problems. We analyze the circuit polytope as an alternative to the traveling salesman polytope as a means of obtaining linear relaxations. We provide a nearly complete characterization of the polytope and suggest efficient separation heuristics. We also show how the circuit formulation can exploit structure in the objective function.

2 - Exact and Heuristic Solutions to the Double TSP with Multiple Stacks
Oli B.G. Madsen, DTU Transport, Technical University of Denmark, ogm@transport.dtu.dk, Claudia Archetti, Hanne L. Petersen, M. Grazia Speranza

The double travelling salesman problem with multiple stacks (DTSPMS) is a pickup and delivery problem where pickups and deliveries are separated, such that all pickup operations are performed before the first delivery takes place. All operations are carried out by one vehicle and no reloading is allowed. The vehicle provides several separated (horizontal) stacks/rows for the transportation of the orders, such that each stack is accessed using a LIFO principle, independently of the other stacks. In a real-life setting the dimensions of the problem is 33 orders each consisting of one euro-pallet, which can be loaded in 3 stacks in a standard 40 foot container. Different exact and heuristic solution approaches to the DTSPMS have been implemented and tested. The exact approaches are based on different mathematical formulations of the problem which are solved using branch-and-cut. One formulation leads to a decomposition approach, consisting of a routing master problem and a loading feasibility subproblem, which generates infeasible paths for the master problem. The latter is the most promising of the tested approaches, and solves all tested problems with up to 15 orders, as well as some larger instances. The implemented heuristics include tabu search, simulated annealing and large neighbourhood search. Particularly the LNS approach shows promising results. It finds the known optimal solution of smaller instances (15 orders) within 10 seconds in most cases, and in 3 minutes it finds solutions to 33 order instances that are on average within 1% of the best known solutions.

3 - Charlemagne's Challenge: The Periodic Latency Problem
Sofie Coene, KULeuven, Naamsestraat 69, Leuven, 3000, Belgium, sofie.coene@econ.kuleuven.be, Frits Spieksma, Gerhard Woeginger

We are given a server travelling at unit speed, and a set of clients with their positions. To each client a periodicity is associated that is the maximal amount of time allowed to pass between consecutive visits of the server to that client. In the PLPP, the goal is then to find a repeatable route for the server visiting as many clients as possible without violating the frequencies. We give polynomial-time algorithms and NP-hardness results.

4 - Traveling Salesman Problem Under Uncertainty Considerations
Konstantin Kalinchenko, Doctorial Candidate, Risk Management and Financial Engineering lab, Department of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, kalinchenkok@gmail.com, Stan Uryasev, Vladimir Boginski, Vladimir Bugera

We consider the Traveling Salesman Problems with stochastic travel times. The length of each arc is a random variable with known distribution. The objective of our exercise is to find a tour with minimum expected length while limiting impact of worst-case (tail) scenarios. Various computational experiments are reported.

■ TC56

H-Room 307, Third Floor

Algorithms and Applications of Polynomial Optimization and Robust Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: X. Andy Sun, Doctoral Candidate, Operations Research Center, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, sunx@MIT.EDU

1 - Efficient First-Order Methods for Polynomial Optimization
X. Andy Sun, Doctoral Candidate, Operations Research Center, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, sunx@MIT.EDU, Dimitris Bertsimas, Robert Freund

We apply efficient first-order methods to polynomial optimization problems (POPs), which are generally difficult to solve. By exploiting special structure of the SDP representation of the POP, we demonstrate that first-order methods have the promise to improve the computational solvability of general POPs. We also explore techniques for solving sparse problems that greatly enhance computational efficiency.

2 - Semidefinite Relaxations for Multistage Robust Optimization and Stochastic Programming
Dan Iancu, Doctoral Candidate, Operations Research Center, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, daniancu@mit.edu, Pablo A. Parrilo, Dimitris Bertsimas

In this work, we introduce a new framework for computing near-optimal policies for multi-stage robust optimization and stochastic programming problems, based on solving a single semi-definite programming relaxation. We demonstrate the performance of the resulting policies numerically, in the context of two classical inventory management applications.

3 - Models for Minimax Stochastic Linear Optimization Problems with Risk

Xuan Vinh Doan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, vanxuan@mit.edu, Dimitris Bertsimas, Karthik Natarajan, Chung-Piaw Teo

We study the minimax stochastic optimization problem with a moment-based distribution class. We show that the model is tractable for problems with random objective and some special ones with random right-hand side. We provide explicit worst-case distributions and compare minimax solutions with data-driven solutions under contaminated distributions. Computational results show minimax solutions hedge against worst-case distributions and provide lower variability in cost than data-driven ones.

■ TC57

H-Room 308, Third Floor

Scheduling of Patients/Physicians in Clinics

Sponsor: Health Applications
Sponsored Session

Chair: Sangbok Lee, Purdue University, School of Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, lee309@purdue.edu

1 - Analysis on Advanced Appointment Systems in Outpatient Clinics: Open Access and Overbooking

Sangbok Lee, Purdue University, School of Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, lee309@purdue.edu, Jong-hyun Ryu, Daiki Min, Yuehwern Yih

Open Access and Overbooking policy are two well-known advanced appointment systems in outpatient clinics. In this study, we investigated different configurations of the two systems in various clinical environments. The performances of the two systems are, then, compared in terms of patients throughput and clinic overwork. Finally, a better hybrid model of the two systems was demonstrated for each clinic environments. A single server simulation model was developed for this study.

2 - A Multi-Stage Stochastic Programming Model for Appointment Scheduling Under Uncertainty

Ayca Erdogan, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, saerdoga@ncsu.edu, Brian Denton

We discuss a multi-stage stochastic programming model to determine the optimal arrival times to a stochastic server given uncertainty in the number of customers to be scheduled. We also describe heuristics for the dynamic appointment sequencing problem, and present empirical results based on optimal scheduling of an endoscopy suite. We discuss the structure of the model, methods for accelerating decomposition based solution methods and specific applications to the outpatient clinic setting.

3 - Physician Scheduling to Improving Spatial Access for Outpatient Specialty Care

Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, 47907, United States of America, nkong@purdue.edu, Peter Fabri

Given a health care provision network that includes a few large medical centers and many local clinics, we in this research consider a problem that schedule physicians' weekly visits to local clinics for outpatient consultations. Our initial aim is to minimize patient travel distance and time. We present several integer programming models to address a number of scheduling constraints and extend the model to incorporate uncertainty in outpatient consultation requests.

4 - Emergency Department Capacity Planning for a Pandemic Scenario: Nurse Allocation

Grisselle Centeno, Associate Professor, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, gcenteno@eng.usf.edu, Florentino Rico

Data on seasonal influenza surveillance is used to forecast patient demand to the Emergency Department using time series analysis and causal models such as neural networks and regression analysis. Forecast results are used to explore a set of potential pandemic influenza scenarios. Results are used as input to a simulation model that evaluates ED capacity and What-If scenarios. We propose an optimized nurse allocation model for the different areas with the objective to improve system efficiency.

■ TC58

H-Room 309, Third Floor

Cyclic Scheduling and Robotic/Cluster Tools

Cluster: Scheduling
Invited Session

Chair: Tae-Eog Lee, Professor, KAIST, Department of Industrial & Systems Eng., 373-1 Guseong-dong, Yuseong-gu, Daejeon, Korea, Republic of, telee@kaist.ac.kr

1 - Robotic Cells with Internal Buffers: Single Gripper and Dual Gripper Models

Neil Geismar, Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, NGeismar@mays.tamu.edu, Milind Dawande, Inna Drobouchevitch, Chelliah Sriskandarajah

We consider the scheduling of robotic cells having input and output buffers at each processing machine. We show that adding internal input buffers to a single gripper cell with internal output buffers does not improve throughput. However, we define a cycle of robot moves in a dual gripper cell with both input and output buffers at each machine that can improve throughput over cells with no internal buffers. This advantage is quantified and the circumstances under which it applies are detailed.

2 - Interplay between OR and Petri Nets for Cyclic Scheduling and Robot Cell & Cluster Tool Scheduling

Tae-Eog Lee, Professor, KAIST, Department of Industrial & Systems Eng., 373-1 Guseong-dong, Yuseong-gu, Daejeon, Korea, Republic of, telee@kaist.ac.kr

Cyclic scheduling, robot cell/hoist/cluster tool scheduling, and Petri nets have been studied by OR and automation communities independently. However, all they address fundamentally equivalent systems, where each resource repeats an identical work cycle. We briefly review interplay issues between OR and Petri nets for scheduling such cyclic systems including linear and mixed integer programming, doubly weighted graphs, time window constraints, Markov chains, cyclic scheduling, etc.

3 - Algorithms for Wafer Transport in Linear Cluster Tools

Kyungsu Park, Master Student, KAIST, Department of Industrial & Systems Eng., 373- Guseong-dong, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, ks-park@kaist.ac.kr, James Morrison

We discuss scheduling algorithms for linear cluster tools in semiconductor manufacturing that address transient states. The algorithms allow for redundant modules and consider lot changes, rolling setups and module failure. The algorithm strives to maximize the cluster throughput and, within the class of such policies, to minimize residency times for wafers inside the tool. The performance of the algorithm is compared to baseline methods via simulation.

4 - An Efficient Optimization Model for Cyclic Scheduling of Cluster Tools

Chihyun Jung, Ph.D. Candidate, KAIST, Department of Industrial & Systems Eng., 373-1 Guseong-dong, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, chjung@kaist.ac.kr, Tae-Eog Lee

Cluster tools are widely used for semiconductor manufacturing. The scheduling problems tend to be more complicated due to advanced tool architectures, complex wafer flow patterns, complex process requirements, and to be difficult to be solved by a commercial solver. We propose an efficient mixed integer programming model that is based on the state evolution equation and token routing decision of a Petri net model of tool behavior rather than conventional models that find a Hamiltonian circuit.

■ TC59

H-Room 310, Third Floor

Tutorial: Assessing Solution Quality in Stochastic Programs via Sampling

Cluster: Tutorials
Invited Session

Chair: David Morton, Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States of America, morton@mail.utexas.edu

Co-Chair: Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu

1 - Assessing Solution Quality in Stochastic Programs via Sampling

David Morton, Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States of America, morton@mail.utexas.edu, Guzin Bayraksan

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

■ TC60

H-Room 311, Third Floor

Semidefinite Programming: Algorithms and Applications

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Bissan Ghaddar, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, bghaddar@uwaterloo.ca

1 - New Relaxations of the Quadratic Knapsack Problem Using Polynomial Programming
Bissan Ghaddar, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, bghaddar@uwaterloo.ca, Miguel Anjos, Juan Vera

Numerous problems in various applications can be expressed using polynomial equalities and inequalities. Polynomial programming, optimizing a polynomial objective function subject to polynomial constraints, is known to be NP-hard in the general case. In our research, we propose new relaxations for the quadratic knapsack optimization problem using polynomial programming. Comparisons based on bounds and computational time are presented.

2 - Strong MIP Formulations for the Unit Commitment Problem
James Ostrowski, University of Waterloo, Waterloo, ON, Canada jostrows@engmail.uwaterloo.ca

In this talk we will discuss the Unit Commitment (UC) problem, an important problem for energy production. We will discuss current mixed integer programming formulations for the UC as well as give a new set of inequalities that can strengthen the linear programming relaxation.

3 - Alternating Direction Augmented Lagrangian Methods for Semidefinite Programming
Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Donald Goldfarb, Wotao Yin

We present an alternating direction method, a two-splitting scheme, based on an augmented Lagrangian framework for solving Semidefinite programming (SDP) problems in standard form. A multiple-splitting algorithm is then proposed to handle SDPs with inequality constraints and positivity constraints directly without transforming them to the equality constraints. Numerical results for frequency assignment, maximum stable set and binary integer quadratic programming problems are presented.

4 - Enhancing RLT Relaxations for Polynomial Problems with a Class of v-Semidefinite Cuts
Evrim Dalkiran, PhD. Candidate, Grado Department of Industrial and Systems Engineering, Virginia Polytechnic Institute & State U, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, dalkiran@vt.edu, Jitamitra Desai, Hanif D. Sherali

We enhance RLT-based relaxations for polynomial programs with a class of v-semidefinite cuts that are derived by imposing positive semidefiniteness on (constraint-factor scaled) dyadic variable-product matrices. We explore various strategies for generating cuts, and exhibit their relative effectiveness for tightening relaxations and solving the underlying polynomial programs. Insights are provided to reveal classes of v-semidefinite cuts that significantly improve performance.

■ TC61

H-Room 312, Third Floor

Logistics/Warehousing

Contributed Session

Chair: Bin Dai, Student, Hong Kong University of Science and Technology, Department of Industrial Eng and Mgmt, A509, HKUST, Clear Water Bay, Kowloon, Hong Kong - ROC, dbbudstar@gmail.com

1 - Analyze Autonomous Vehicle Storage and Retrieval Systems by Semi-open Queing Networks
Xiao Cai, University of Louisville, 205 Nob Hill Ln 7, Louisville, KY, 40206, United States of America, x0cai001@louisville.edu

The autonomous vehicle storage and retrieval system (AVS/RS) is a relatively new automated warehouse material handling technology. There are few papers in the literature on performance evaluation of AVS/RS. In this paper, we model the AVS/RS as a semi-open queueing network (SOQN) and present an efficient, approximate algorithm to evaluate performance measures of this SOQN.

2 - Workforce Implications in Warehouses and Distribution Centers
Lourdes Medina, Graduate Student, The Pennsylvania State University, 202 Cunningham Hall, Weston Community Center, University Park, PA, 16802, United States of America, lam458@psu.edu, David Nembhard

This work investigates important aspects for the workforce of warehouses and distribution centers. A review of the literature is provided, defining eight relevant topics. The main focus is given to logistics publications. The evaluated concepts consist of: recruitment, retention, management coaching behavior, work environment, safety issues, training, company size and technology. Furthermore, critics are given and opportunities for future work are defined.

3 - A Study of ETV in Airport Cargo Terminal
Junjae Chae, Assistant Professor, Korea Aerospace University, 100 Hanggongdae-gil, Hwajeon-Dong, Keokyang-gu, Goyang, 412-791, Korea, Republic of, jchae@kau.ac.kr, Yoonseok Chang, Sanghyeon Kim, Moonsu Lee

ETV (Elevating Transfer Vehicles) system is similar to AS/RS but is different from AS/RS. It is used in airport cargo terminal for handling aircraft ULD containers in the multilevel mass storage system. Because the size of handling material and the mechanism for moving material are different, there is no insuring that the rule for operational efficiency for AS/RS is applicable to ETV system. This study tests the validity of the rules for AS/RS applied to ETV and find the applicable rule for ETV.

4 - Mathematical Modeling of the Colombian Sugar Cane Supply Chain
Carolina Saldaña, Universidad Externado de Colombia, Calle 12 1 17 Este, Bogota, Colombia, jenny.saldana@uexternado.edu.co, Carlos Osorio-Ramirez

In this paper a mixed integer programming model is presented in order to describe and analyze the colombian sugar cane supply chain.

5 - Sensor Placement for Implementing Ultrasonic Sensor Network
Bin Dai, Student, Hong Kong University of Science and Technology, Department of Industrial Eng and Mgmt, A509, HKUST, Clear Water Bay, Kowloon, Hong Kong - ROC, dbbudstar@gmail.com, Ka Shek Lee

Ultrasonic sensor network is promising for manufacturing and warehouse. One of the fundamental problems of implementing ultrasonic sensor network is the placement of ultrasonic sensors. In this study, a nonlinear program has been developed to study the 3-dimension sensor placement problem and sensor deployment strategy. Moreover, the performances of different deployment methods are evaluated by simulation and real experiments. Finally the guidelines of ultrasonic sensor placement are presented.

■ TC62

H-Room 313, Third Floor

Behavioral Operations Management

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, aovchinnikov@darden.virginia.edu

1 - Dual Sales Channel Management with a Buyback Contract
Murat Kaya, Assistant Professor, Sabanci University, Sabanci Universitesi MDB Fakultesi, Orhanli Tuzla, Istanbul, 34956, Turkey, mkaya@sabanciUniversityedu

We study how a manufacturer can use a buyback contract to manage dual sales channels: An online direct channel and an independent retail channel. The channels compete in service, where service is defined as the delivery lead time in the direct online channel and product availability in the retail channel. We compare the outcomes under wholesale price and buyback contracts in dual, direct-only and retail-only channels structures.

2 - Darden's Luckiest Student (DLS) High-Stakes Risk Experiment
Sam Bodily, Darden School Univ of VA, 100 Darden Boulevard, Charlottesville, VA, 22903, United States of America, bodilys@darden.virginia.edu, Phil Pfeifer

We report experiments wherein student attitude towards risk with 50/50 outcomes of $0 or a full-semester of tuition was elicited from two successive MBA classes. In the first class, students were first asked for certainty equivalents (CEs) to a hypothetical lottery and then later for a real lottery. In the later class, we studied the effect on risk attitude of a) buying versus selling price, b) seeing a video of a student getting zero the previous year and c) whether responses were made public.

3 - Revenue and Cost Management for Remanufactured Products
Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, aovchinnikov@darden.virginia.edu

We present a model of firm's remanufacturing operations and a behavioral study that estimates its key element - a function that describes the fraction of consumers who switch from new to refurbished product. Our behavioral study shows that this function has an inverted-U shape and hence cannot be modeled using the popular WTP-based approach. We solve the model for both the inverted-U and WTP-based behaviors and comment on how firm's policy changes.

■ TC63

H-Room 314, Third Floor

Resource Allocation in Health Care

Contributed Session

Chair: Alia Stanciu, Assistant Professor of Management, Bucknell University, 322 Taylor Hall, School of Management, Lewisburg, PA, 17837, United States of America, alia.stanciu@bucknell.edu

1 - Developing Federal Resource Allocation Strategies to Mitigate Cross-regional Pandemic Outbreaks
Alex Savachkin, Assistant Professor, University of South Florida, 4202 E. Fowler Ave, Tampa, FL, 33620, United States of America, savachki@eng.usf.edu, Tapas Das, Andres Uribe, Diana Prieto

We present a simulation based optimization methodology to develop strategies for deploying scarce federal resources during the spread of cross-regional pandemic outbreaks. The simulation includes a comprehensive characterization of virus epidemiology, social dynamics, and containment strategies. The simulation embeds a dynamic cost-based optimization model to generate federal mitigation strategies subsuming regional policies for vaccination, antiviral application, and social distancing.

2 - Estimating the Effect of Vaccination Policies for Smallpox Outbreak
Yingtao Ren, PhD Student, Daniel J. Epstein Department of Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089-0193, United States of America, yingtaor@usc.edu, Fernando Ordonez

To assist policymakers planning an efficient response, we propose a mathematical model to estimate the number of deaths using different vaccination strategies for a smallpox outbreak in a single city. Our results show that our model approximates well-published simulation models. Based on the model, we derived the threshold for deciding which strategy to implement to minimize the number of deaths. The simplicity of the model allows its use in a network model to plan for a nationwide response.

3 - Incentives for Multi-level Allocation of HIV Prevention Resources- A Game Theoretic Approach
Monali Malvankar, PhD Candidate, Ivey School of Business, University of Western Ontario, 1151 Richmond St North, London, ON, N6A3K7, Canada, mmalvankar@ivey.uwo.ca, Xinghao Yan, Greg Zaric

HIV prevention funds often traverse several levels of decision-making. Decision makers at each level use equity-based heuristics that may lead to sub-optimal allocation. We model the allocation process as a Stackelberg game in which an upper-level decision maker uses an incentive scheme based on preferences of the lower-level decision makers to encourage optimal allocation of prevention funds.

4 - Demand Management in Health Care: Protection Levels under Random Resource Requirements
Alia Stanciu, Assistant Professor of Management, Bucknell University, 322 Taylor Hall, School of Management, Lewisburg, PA, 17837, United States of America, alia.stanciu@bucknell.edu, Luis Vargas

We consider how to set protection levels in a service system with groups of customers, when the resource demands of the customers are random variables. This is particularly true in surgical units. We show how the calculation of the protection levels changes when one of the groups' demand always exceeds system capacity, and the relationship of the formulas in the random case to those in the traditional case of deterministic resource requirements.

■ TC64

H-Room 202A, Second Floor

Education I

Contributed Session

Chair: Nicola Petty, Senior Lecturer, University of Canterbury, Private Bag 4800, Christchurch, 8140, New Zealand, nicola.petty@canterbury.ac.nz

1 - Ideas for Improving LP in Introductory Textbooks to Improve Teaching
Shane Dye, Senior Lecturer, University of Canterbury, Private Bag 4800, Christchurch, 8140, New Zealand, shane.dye@canterbury.ac.nz, Nicola Petty

In this paper we introduce three complementary practices to improve the teaching of linear program models in spreadsheets to entry-level business students: "Explore, standardise and repeat". These are supported by the results of educational research, and the experience of teaching LP to entry-level business students for over twenty years. A number of popular textbooks are examined to see how well they fit with these ideas.

2 - An Innovative Approach to Teach the Risk Pooling Concept
Lindsey Scheggia, Shippensburg University, 1871 Old Main Drive, Shippensburg, PA, 17257, United States of America, ls7467@ship.edu, Robert Setaputra

Risk pooling is of great importance in the business field, especially in areas such as supply chain and operations management. Teaching the concept of risk pooling is fairly easy; yet providing practical examples proves a little more difficult. The objective of this paper is to research and provide several real life cases that would further a student's understanding of this concept.

3 - A Graphic Novel for Management Science Education
Robert Hampshire, Carnegie Mellon University, 4800 Forbes Ave, Pittsburgh, United States of America, hamp@cmu.edu

I will introduce a graphic novel series called Super Operations Manager. The graphic novel has been used in the classroom to further the learning of management science concepts. This talk will describe and evaluate the class room use of this graphic novel.

4 - Solving Two Stage Stochastic Programs in Excel
Tom Robbins, Assistant Professor, East Carolina University, College of Business, 3212 Bate Building, Greenville, NC, 27858, United States of America, robbinst@ecu.edu

Stochastic Program formulations are known to provide superior solutions to optimization problems with uncertain parameters. However, due to the difficulty in formulating and solving stochastic programs many researchers resort to solving the mean value approximation. In this talk we discuss the practicality of formulating and solving two stage stochastic programs in Excel using a new version of Frontline Systems Solver Add-In, Risk Solver Platform.

5 - Teaching Operations Research and Statisics with Videos on Youtube
Nicola Petty, Senior Lecturer, University of Canterbury, Private Bag 4800, Christchurch, 8140, New Zealand, nicola.petty@canterbury.ac.nz

Short video clips teach difficult concepts effectively. Students receive information through aural and visual channels and can pause or watch multiple times. Nicola Ward Petty has developed ten short amusing videos to teach aspects of Excel, linear programming, and inference. They are on www.youtube.com/ucmsci and have been viewed by thousands internationally. In this presentation she explains how these videos have been effective, and gives guidelines for developing such clips.

■ TC65

H-Room 202B, Second Floor

Inventory Management During Transition

Contributed Session

Chair: Suresh K Goyal, Professor, Concordia University, John Molson School of Business, Montreal, QC, H3G1M8, Canada, sgoyal@jmsb.concordia.ca

1 - End-of-life Inventory Decisions for Consumer Electronics Spare Parts
Morteza Pourakbar, Erasmus School of Economics, Erasmus University Rotterdam, BurgOudlaan 50, Rotterdam, 3000DR, Netherlands, pourakbar@ese.eur.nl, Rommert Dekker, Hans Frenk

We consider consumer electronics (CE) manufacturer problem of controlling the inventory of spare parts in the final phase. Pertinent research in the literature consider the repair of defective products as the only way to meet demand. But

considering the price erosion factor of CE products over time, we seek to build policies aiming at finding the optimal final order quantity and time to switch to an alternative replacement policy, such as swapping, during this phase of service life cycle.

2 - A Continuous-time Examination of the Last Buy Problem
Nicholas Leifker, Graduate Fellow, University of Iowa, Mgmt. Sci. Department, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, nicholas-leifker@uiowa.edu, Philip Jones, Timothy Lowe

The goal of the last buy problem is to find the optimal order amount for spare parts during the post-manufacture phase of a product's life. We assume an exponential lifetime distribution for both the assemblies and spare parts. We then determine continuous-time distributions for the rate of change of demand, and find time-discounted costs as a function of the order amount. We then find the optimal order amount by examining the rate of change of the cost as a function of order amount.

3 - Initiation of an Inventory Control System
Sven Axsater, Professor, Lund University, Box 118, Lund, 22100, Sweden, sven.axsater@iml.lth.se

This paper considers a single-echelon inventory system with a warehouse facing compound Poisson customer demand. The replenishment lead-time is constant. There are standard holding and backorder costs but no set-up or ordering cost. It is assumed that the demand process starts at a certain given time. We derive the optimal transient ordering policy under this assumption.

4 - A One-time Excess Inventory Disposal Decision under Stochastic and Price Dependent Demand
Xiaoyan Zhu, Assistant Professor, University of Tennessee, 307 East Stadium Hall, Knoxville, TN, 37996, United States of America, xzhu5@utk.edu, Sila Cetinkaya

We consider a periodic-review stochastic inventory system which will be switched to a new base-stock policy. Hence, excess on-hand inventory that exceeds the new order-up-to level must be disposed of. Focusing on the case where the demand during the disposal period is a price dependent random variable, we develop a general model maximizing the sum of expected disposal income and the expected discounted future revenues minus costs. Our goal is to compute the optimal disposal quantity.

5 - One-time Only Promotions for Multiple Products under Financial Constraints
Suresh K Goyal, Professor, Concordia University, John Molson School of Business, Montreal, QC, H3G1M8, Canada, sgoyal@jmsb.concordia.ca, Satyaveer Chauhan

In this paper we formulate the inventory problem of multiple products where one or more suppliers have offered limited term promotions. We suggest a solution approach for the buyer to take advantage of such an offer under financial constraints.

■ TC66

H-Room 204A, Second Floor

Production and Hedging in Supply Chains

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Sridhar Seshadri, Professor, University of Texas Austin, Department of IROM, Austin, United States of America, Sridhar.Seshadri@mccombs.utexas.edu

1 - Are Financial Markets Important for Your Supply Chain?
Nikolay Osadchiy, PhD Candidate, New York University, 44 West 4th St, New York, NY, 10012, nosadchi@stern.nyu.edu, Vishal Gaur, Sridhar Seshadri

We conduct empirical investigation of the correlation between demand and financial market returns in a supply chain setting. We find that this correlation is the lowest at the retailers' level and increases for upstream levels of a supply chain. We discuss the bullwhip effect, lead time, excess inventory, and manufacturing capacity as potential causal factors. Our results shed light on the sources of volatility in supply chains.

2 - Investments, Hedging, and Frictions
Kumar Muthuraman, Professor, McCombs School of Business, kumar@austin.utexas.edu

The objective of this paper is to analyze the interplay between operational (capacity expansion and production) and financial (dividends and financial hedging) decisions. We examine the effects of frictions in operational decisions (capacity expansion costs and capacity expansion delays) on firm's joint operational and financial policy. We consider a model that captures these interactions. Using optimal policies for this model we answer several questions that provide insights.

3 - A Constant-Q Heuristic for Spot and Forward Procurement
Burcu Tan, PhD Candidate, University of Texas at Austin, IROM, B6500, 1 University Station, Austin, TX, 78712, United States of America, Burcu.Tan@phd.mccombs.utexas.edu, Ganesh Janakiraman, Sridhar Seshadri

We analyze the effectiveness of a simple ordering heuristic for commodities procurement from spot and forward markets. The heuristic calls for ordering a fixed quantity from the forward market at each period generating a steady inflow and then making adjustments through the spot market. We build on Goel and Gutierrez (2006), which provides the optimal policy for spot and forward procurement in a framework that incorporates the marginal convenience yield.

■ TC67

H-Room 204B, Second Floor

Data Envelopment Analysis: Methods and Applications

Cluster: Data Envelopment Analysis
Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu

1 - Modeling Weak Disposability in Data Envelopment Analysis under Relaxed
Timo Kuosmanen, Professor, Helsinki School of Economics, POB 1210, Helsinki, 00101, Finland, timo.kuosmanen@mtt.fi, Victor Podinovski

Treatment of undesirable outputs in DEA requires replacing the free disposability assumption by weak disposability. Kuosmanen (2004) technology is the correct convex technology exhibiting weak disposability. This paper relaxes the full convexity and considers: 1) output sets are convex, 2) no convexity is assumed. We first show that the Shephard technology is larger than necessary. We then develop the correct models for both cases and give an axiomatic definition of the Shephard technology.

2 - A Data Density Test for Non-parametric Production Sets
Ole Olesen, University of Virginia, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America ole@sam.sdu.dk, Jens Leth Hougaard, Mette Asmild

Maintaining a common inefficiency distribution a binomial test is proposed for over-representation of data in a convex cone within a DEA production possibility set. Volumes of slices of i) a convex hull estimator and ii) the intersection of this set with a "rational inefficiency cone" are estimated. The suggested approach is illustrated using a Monte Carlo simulation and an empirical example.

3 - Stochastic Production Frontier Analysis With Multiple Outputs: A Two-Stage Approach
John Ruggiero, John.Ruggiero@notes.udayton.edu, Andy Johnson, Trevor Collier

One of the disadvantages of the stochastic frontier model is the inability to measure inefficiency in the presence of multiple outputs without appealing to the cost side. DEA proponents cite the ability of DEA to handle multiple inputs and multiple outputs as a distinct advantage over the stochastic frontier models. We provide a two-stage multiple output stochastic frontier model that does not require input prices. We analyze the performance of the model using a Monte Carlo design.

■ TC68

H-Room 206, Second Floor

Stochastic Programming Models in Supply Chain Management

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Kai Huang, Assistant Professor, Binghamton University, School of Management, Binghamton University, Binghamton, NY, 13902, United States of America, huang@binghamton.edu

1 - Dynamic Fleet Scheduling with Uncertain Demand and Customer Flexibility

Jonathan Turner, PhD Student, Northewestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, JonathanTurner@u.northwestern.edu, Mark Daskin, Karen Smilowitz, Tito Homem-de-Mello, Soonhui Lee

Our dynamic fleet reduction model demonstrates how a carrier can improve fleet utilization by offering rebates to customers that accept alternate delivery times. The model makes decisions at stages as demand is revealed throughout an order horizon. It does so by sampling anticipated demand to avoid recourse penalties in later stages. The added value of incorporating stochasticity is affected by the customers' willingness to wait for delivery commitments and the order lead time distribution.

2 - Convex Approximations of a Multiperiod Probabilistically-Constrained Model with Random Disruptions

Tara Rengarajan, PhD Student, Operations Research Program, University of Texas at Austin, ETC Building, 204 East Dean Keeton St., Austin, TX, 78705, United States of America, tara_rengarajan@mail.utexas.edu, Nedialko Dimitrov, David Morton

We study a convex approximation of a multiperiod probabilistically-constrained program for hedging against random disruptions. We develop an optimal stratified sampling scheme subject to a computational budget, and show this can improve over naive sampling by an order of magnitude in the number of time periods provided the number of disruptions is small. We demonstrate the performance of our scheme on examples from inventory control.

3 - A Comparison Study of Cost Minimization and Reward Maximization Models in Assemble-To-Order Systems

Kai Huang, Assistant Professor, Binghamton University, School of Management, Binghamton University, Binghamton, NY, 13902, United States of America, huang@binghamton.edu, Ton de Kok

We continue to report on our progress on the study of stochastic programming models in ATO systems. In classical inventory theory, there are two types of objectives: cost measures and service measures, whose relationship has been extensively studied. However, in ATO systems, such a comparison study is missing. The recent progress on the stochastic programming models allow us to compare these models in an ATO system. Such a comparison study provides us insights that were not shown before.

4 - The p-Median Location Problem: A Counter-measure Policy to Mitigate Random Facility Disruptions

Qingwei Li, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, qli4@mail.usf.edu, Bo Zeng, Alex Savachkin

Facilities in the conventional p-median facility location problem fail in reality due to random disruptions such as natural hazards or man-made malignant acts. We extend the conventional p-median facility location problem by assuming that each facility fails with a different probability. We then develop a counter-measure investment strategy to improve reliability of individual facilities and conduct a sensitivity analysis on the total available investment budget.

■ TC69

H-Indigo A, Second Floor

Environmental Operations I

Contributed Session

Chair: Jing-Quan Li, Assistant Research Engineer, Calfornia PATH, UC Berkeley, Richmond, CA, 94804, United States of America, jingquan.li@gmail.com

1 - Modeling to Generate Alternatives in Waste Management Planning Using Simulation-optimization

Julian Scott Yeomans, York University, Schulich School of Business, OMIS, SSB 338, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, syeomans@schulich.yorku.ca

It has been shown in environmental policy formulation that it is preferable to create several good alternatives that provide very different approaches to a problem. This study shows how simulation-optimization can be used to generate multiple policy alternatives that satisfy required system criteria and yet are maximally different in decision space. The efficacy of this stochastic modelling-to-generate-alternatives approach is demonstrated on a waste management planning application.

2 - Modeling Integrated Crop-livestock Systems in Iowa

Guiping Hu, Iowa State University, 3033 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu

Sustainable agriculture is gaining popularity due to the increasing concern over environmental issues, including pollution and energy and natural resource conservation. In this study, we integrate the crop production and livestock systems for the purpose of reducing external inputs and maximizing nutrient recycing. With Linear programming methodology, we model this decision making problem quantitatively. Case studies and analyses are carried out with real field data.

3 - Managing Selective Catalytic Reduction for Coal-fired Power Plants

Passakorn Phananiramai, University of Texas at Arlington, Industrial & Manufacturing Systems Engr., Campus Box 19017, Arlington, TX, 76019-0017, United States of America, passakorn.phananiramai@mavs.uta.edu, Jay Rosenberger, Clint Carter, Don Harris, Victoria Chen, Seoung Bum Kim, Melanie Sattler, Sadegh Sadeghipour

Selective catalytic reduction (SCR) is an emission control technique that reduces harmful oxides of nitrogen (NOx) emissions. In this research, we develop an SCR management tool that finds an optimal SCR management plan which minimizes NOx emissions using mathematical optimization techniques. We demonstrate the effectiveness of the tool and provide a tradeoff between NOx reductions and operating costs using Pareto optimal efficient frontiers. Finally, we discuss topics of future research.

4 - The Energy Box: Locally Automated Optimal Control of Residential Electricity Usage

Daniel Livengood, PhD Candidate, Massachusetts Institute of Technology, 550 Memorial Drive, Apt 23B-3, Cambridge, MA, 02139, United States of America, dlivengo@mit.edu, Richard Larson

The Energy Box is proposed as a 24/7 service via a background processor operating on a local computer or remote location, silently managing one's home or small business electrical energy usage. It operates best in an environment of demand-sensitive real-time pricing. We assume that, in time, virtually every electrical device in a home or small business will be controllable from the Energy Box. The primary integrating method of optimization and control is stochastic dynamic programming.

5 - Sustainability Provisions in the Bus Scheduling Problem

Jing-Quan Li, California PATH, University of California-Berkeley, Richmond, CA, 94804, United States of America, jingquan@path.berkeley.edu, Larry Head

The traditional vehicle scheduling problem attempts to minimize vehicle capital and operating costs. However, the carbon footprint and toxic air pollutants have now become increasingly important to society. This paper studies the bus scheduling problem and evaluates new types of buses that use alternative energy sources to reduce emissions, including some toxic air pollutants and carbon dioxide.

Tuesday, 4:30pm - 6:00pm

■ TD01

C-Room 21, Upper Level

Portfolio Decision Analysis Panel Discussion

Sponsor: Decision Analysis
Sponsored Session

Chair: Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, TKK, 02015, Finland, ahti.salo@hut.fi

1 - Portfolio Decision Analysis Panel Discussion

Moderator: Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, 02015, Finland, ahtisalo@cc.hut.fi, Panelists: Jeff Keisler, Alec Morton

In this panel, leading researchers and practitioners discuss how portfolio decision analysis can be best harnessed in support of organizational decision making. Among other things, the panelists will consider preconditions for the successful deployment of methods, summarize 'lessons learned' from their professional experience and identify future research needs. The panelists include presenters such as David Matheson, Don N. Kleinmuntz, Carl Spetzler and Larry Phillips (to be confirmed).

■ TD02

C-Room 22, Upper Level

Decision Analysis Arcade I

Sponsor: Decision Analysis
Sponsored Session

Chair: Yael Grushka-Cockayne, University of Virginia, 100 Darden Blvd., Charlottesville, VA 22903, United States of America, ygrushka.phd2003@london.edu

1 - Detecting Credit Card Fraud with Hybrid Influence Diagrams
Barry Cobb, Associate Professor, Department of Economics and Business, Virginia Military Institute, Lexington, VA, United States of America, cobbbr@vmi.edu

An influence diagram model can be used to detect online credit card transactions that may be fraudulent. By creating decision rules based on merchandise value and additional address and product characteristics, the model can be used to develop policies that help businesses decide when to investigate an order's legitimacy.

2 - Diversifying Ambiguity: How Individuals Evaluate Multiple Uncertain Prospects
Dolchai La-ornual, Ph.D. Student, INSEAD, Boulevard de Constance, Fontainebleau Cedex, 77305, France, dolchai.la-ornual@insead.edu

We examine whether individuals perceive benefits from diversification when prospects are ambiguous and how those benefits compare to analogous situations under risk. Results from a series of experiments suggest that individuals derive less benefit from diversification under ambiguity than under risk. However, people seem to diversify to a greater extent when prospects are ambiguous. This may be due to adjustments of exposure to aleatory uncertainty in presence of epistemic uncertainty.

3 - Accuracy of Entropy Approximations for Multivariate Discrete Distributions
Luis Montiel, PhD Student, The University of Texas, 1 University Stateion, C2200, Austin, TX, 78712, United States of America, LVM92@mail.utexas.edu, J. Eric Bickel

Assessing joint probability distributions is often difficult, requiring many heavily conditioned assessments. To simplify the process, decision analysts frequently use maximum entropy approximations. How good are these approximations in the face of limited information? In this talk, we will explore the behavior of entropy approximations for multivariate discrete distributions, in which the variables are not necessary binary, and the relation to the correlation structure of the distribution.

■ TD03

C-Room 23A, Upper Level

Multi-objective Problems in Medicine

Cluster: Multi-Criteria Decision Making
Invited Session

Chair: Vira Chankong, Associate Professor, Case Western Reserve University, Electrical Engineering and Computer Scie, 10900 Euclid Avenue, Olin 708, Cleveland, OH, 44106, United States of America, vira@case.edu

1 - Challenges in Applying Compressive Sampling to MR Imaging
Nicole Seiberlich, Research Associate, Case Western Reserve University, 11100 Euclid Ave, MRI Research - Bolwell B121, Cleveland, OH, 44106, United States of America, nicole.seiberlich@case.edu, Mark Griswold

MRI is a leading medical imaging modality. MRIs primary drawbacks are limited sensitivity and speed. Compressed sensing (CS) has the potential to greatly improve both of these areas. However, many issues limit the applicability of CS to MRI. Here we will discuss some of these limitations and some of the early attempts and why some of them have failed. In particular we will focus on real-life examples of how MRI data is sampled and how this relates to the theory of compressive sampling.

2 - Conformal Avoidance – The Multi-objective Treatment Planning Paradigm for Cancer Radiation Therapy
Q Jackie Wu, Associate Professor, Duke University Medical Center, Department of Radiation Oncology, 3295 DUMC, Durham, NC, 27710, United States of America, jackie.wu@duke.edu

Since the radiation kills living cells along its pathway, the goal of caner radiation treatment is to focus the radiation to cancers and avoid the radiation damage to neighboring critical organs and normal tissues. The planning has to consider different organs responses to radiation intensity and volume and prescription target radiation, a multi-objective paradigm in daily clinical practice.

3 - Three Competing Objectives in Diagnostic and Therapeutic Medicine
Vira Chankong, Associate Professor, Case Western Reserve University, Electrical Engineering and Computer Scie, 10900 Euclid Avenue, Olin 708, Cleveland, OH, 44106, United States of America, vira@case.edu

Speed, effectiveness and low side effects are three common competing objectives in diagnostic and therapeutic medicine. This talk will attempt to highlight the multi-objective nature of diagnostic and treatment planning problems in compressive sensing for medical imaging, Intensity Modulated Radiation Therapy and Arc Radiation Therapy and to explore approaches to assist healthcare providers to make the best-compromised decisions.

■ TD04

C-Room 23B, Upper Level

Data Mining Applications

Sponsor: Data Mining
Sponsored Session

Chair: Rong Duan, Principle Member of Tech Staff, AT&T, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com

1 - Classifying Services by Customer Specified Performance Dimensions
Venkat Venkateswaran, Clinical Associate Professor, RPI Hartford, Room 725, 275 Windsor Street, Hartford, CT, 06120, United States of America, venkav3@rpi.edu, John Maleyeff

We study a classification method where services are grouped by dimensions of performance important to customers rather than commonality of process characteristics. A sample of 165 services were rated (0/1) on 9 dimensions important to customers. The resulting binary vectors were then grouped into 8 sets using a binary vector clustering procedure. The sets produced are quite different from what would result from traditional schemes. Implications for service innovation and staffing are discussed.

2 - Anomaly Detection with Real-time Contrasts
Houtao Deng, PhD student, Department of Industrial, Systems and Operations Engineering, Arizona State University, Tempe, AZ, 85287-5906, United States of America, hdeng3@asu.edu, George Runger

System monitors to detect anomalies in high-dimensional data streams are important for many applications. Previous work transformed the problem to supervised learning so that robust machine learning tools could be applied. A more computational method is used here to transform the problem and compared to previous results.

3 - Manipulation Robustness of Collaborative Filtering Systems
Xiang Yan, Stanford University, Packard 274, Stanford, CA, United States of America, robbie.yan@cs.stanford.edu, Benjamin Van Roy

Collaborative filtering systems, which recommend to users products that similar users like, have become targets of manipulation by unscrupulous vendors. We provide theoretical and empirical results demonstrating that while common nearest neighbor algorithms, which are widely used in commercial systems, can be highly susceptible to manipulation, two classes of collaborative filtering algorithms which we refer to as linear and asymptotically linear are relatively robust.

4 - Sentiment Analysis of Stocks Based on News Articles
Ronen Feldman, Professor, Hebrew University, School of Business Admin., Jerusalem, Israel, ronen.feldman@huji.ac.il

We present CARE - a brand new hybrid Machine Learning/Knowledge Engineering-based system for extracting complex relations from free natural language text. We then show two applications that utilize CARE. The first application extracts business events out of news articles and serves as a foundation for an alert mechanism for investors. The second application scores each of the S&P 500 stocks according to the positive/negative sentiment that appears in news articles that are related to it.

■ TD05

C-Room 23C, Upper Level

Joint Session QSR/ HAS: Defining the Science of Quality in Public Health

Sponsor: Quality, Statistics and Reliability & Health Applications Sponsored Session

Chair: John Fontanesi, Director, University of Califonia SD, San Diego, CA, jfontanesi@ucsd.edu

1 - What Does Quality Mean in Public Health

F. Douglas Scutchfield, Peter P Bosomworth Professor of, University of Kentucky, 121 Washington Ave, Lexington, KY, 40536-0003, scutch@email.uky.edu

Public Health , with roots in providing clean water and sanitary living conditions, has evolved into a complex entity with responsibilities as diverse as purchasing 75% of the vaccines purchased in America, auditing health care facilities for safety, establishing heath policies on issues such as obesity and smoking : all the while working in a political framework. The challenges of identifying what quality in public health is and how the OR community can develop measures will be discussed

2 - Challenges in 'Scoring' Health Care Quality: Perspective From the Joint Commission

Ann Watt, Associate Director, Division of Quality Measurement and Research, Joint Commission, One Renaissance Blvd, Oakbrook Terrace, Il, 60181, United States of America, awatt@jointcommission.org

The Joint Commission is responsible for assessing and certifying the quality of American hospitals and some ambulatory care centers. How these measures are selected and what challenges are present for the OR community to improving quality of care will be discussed

3 - Operational Challenges of the Vaccines for Children Program

Nancy Fasano, Director, CDC VAccinnes for Children Program, NAF5@CDC.GOV

The Vaccines for Children Program is a $3 billion federal entitlement program administered by the CDC that provides vaccines for eligible children according to the authorizing legislation, and reporting each year to the Office of Management and Budget. Discussed will be the challenges of balancing efficiency with convenience, accountability with flexibility, Local vs centralized control and resource allocation under public health mandates. What could be the role of Operational Science?

4 - Baldridge Here We Come:Challenges in Identifying Quality Measures in Public Health

Nick Macchione, Director, San Diego County Health and Human Services, Nick.Macchione@sdcounty.ca.gov

Public Health is now a complex operation in which good ideas without public support are bad ideas. Presented will be an outline of a model of public health with challenges to the OR/MS community to help in developing quality measures: Baldridge-here we come.

■ TD06

C-Room 24A, Upper Level

Prognostics/Health Management, Sensors, and RFID I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Abe Zeid, Northeastern University, College of Engineering, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zeid@coe.neu.edu

Co-Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, 334 Snell Engineering Center, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

1 - RFID-enabled Process Visualization and Analysis in Ambulatory Care

Yi-Chin Lin, Carnegie Mellon University, 515 S Aiken Ave Apt 503, Pittsburgh, PA, 15232, United States of America, yichinl@andrew.cmu.edu, Rema Padman, Kai Zheng

We analyze patient throughput and process visibility for care delivery processes using time and location stamped data collected from RFID tags worn by patients, clinicians, and staff. We identify generalizable best practices using process visualization, pattern analysis, and simulation tools in an outpatient practice.

2 - Multiple Objective Optimization of Performance Based Logistics

Delia Villanueva, MS student, Industrial Engineering Department. The University of Texas at El Paso, 500 W. University Av., El Paso, TX, 79968-0521, United States of America, dvillanueva3@miners.utep.edu, Olivia Moreno, Heidi Taboada

A new Performance Based Logistics (PBL) optimization model is presented. PBL is one of the newest support strategy of the Department of Defense to improve the weapon system readiness. This work introduces a new multiple objective evolutionary approach that simultaneously optimizes objectives such as reliability, maintainability, and supportability. These objectives are based on procurement, operation, and maintenance components of the total cost of ownership.

3 - Effective Real Time Maintenance Management

Hatice Ucar, Research Assistant, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, hucar@wayne.edu, Ratna Babu Chinnam, Alper Murat

Manufacturing plants, in particular demanding facilities such as automotive body shops, have many stations with different maintenance requirements. Unless the stations are well maintained they will have increasing failure rates, which degrades throughput by time. Our real-time decision support system helps avoid production losses by guiding maintenance supervisor prioritize repair of simultaneously failed stations and schedule preventive maintenance depending on stations' remaining useful life.

4 - Optimal EPQ and Preventive Maintenance Plan under SPC

Yarlin Kuo, Professor, Yunlin University of Science and Technology, 123 University Road, Touliu Yunlin, Taiwan - ROC, kuoyl@yuntech.edu.tw, Syu-Jheng Syu

This paper finds the optimal EPQ and the optimal preventive maintenance plan of a failure prone production system under the EPQ and SPC setting. Assume that the unobservable machine failure causes the process to shift to out-of-control. Expression of average cost per unit time is derived based on renewal reward theorem. Nnumerical studies indicate that more efficient maintenance practice is more effective in reducing average cost then the reduction in production setup cost.

■ TD07

C-Room 24B, Upper Level

Design and Analysis of Experiments in Modern-day Science and Technology

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Tirthankar Dasgupta, Harvard University, Science Center, Dept of Statistics, 1, Oxford St, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu

1 - Multi-Objective Optimal Experimental Designs in Event-Related fMRI Studies

Abhyuday Mandal, University of Georgia, Athens, GA, 30602-7952, United States of America, amandal@stat.uga.edu, Dibyen Majumdar, John Stufken, Ming-Hung Kao

Obtaining efficient designs for event-related functional magnetic resonance imaging (ER-fMRI) is arduous. Kao et al. (2009) proposed an efficient approach for finding good ER-fMRI designs. As other methods known hitherto, our approach fails to take into account the link between estimation of the HRF and detection of active brain voxels. Here we consider a nonlinear model to accommodate both goals in a unified setting, define design criteria to evaluate designs and search optimal designs.

2 - Efficient Data Collection Methods for Modern Meta-Analysis

Peter Qian, Assistant Professor, University of Wisconsin-Madison, 1300 University Ave, Department of Statistics, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

Meta-analysis is becoming increasingly popular in many modern scientific and engineering fields. Examples include emulation based on a host of similar computer models in geosciences and statistical integration of genomic data from multiple sources. This talk reports some recent advances in experimental design methods for meta-analysis.

3 - Fast Calibration of Complex Computer Models

Derek Bingham, Professor, Simon Fraser University, 8888 University Ave, Burnaby, BC, Canada, dbingham@stat.sfu.ca, Stephan Sain, Matt Pratola

Our work arises from a study of parameters that governs the behavior of electron storms in the upper atmosphere that presents challenges that make the standard model calibration methods problematic. The first is the large output data structure and the second is that the process response surface is not well represented by a stationary covariance. We propose new methodology for the design and analysis of calibration experiments that is effective in this setting.

4 - Proposal of "Multi-Sigma" to Optimize a Complex System with Many Inputs and Trade-off Outputs

Kotaro Kawajiri, Researcher, National Institute of Advanced Industrial Science and Technology, 16-1 Onogawa, Tsukuba, Japan, kotaro-kawajiri@aist.go.jp

Nowadays, a system of manufacturing becomes large and complex with many inputs and trade-off outputs. A novel scheme "Mlti-Sigma"is proposed to optimize such a complex system easily by design of experiment and genetic algorithm. Experiments are conducted and the results are analyzed statistically by design of experiment. Outputs are optimized by genetic algorism using regression formula obtained by statistic analysis. The effect of the scheme is verified by some case studies in this study.

■ TD08

C-Room 24C, Upper Level

Data Mining Contest

Sponsor: Data Mining
Sponsored Session

Chair: Claudia Perlich, Research Staff, IBM T.J. Watson Research Center, P. O. Box 218, Yorktown Heights, NY, 10598, United States of America, perlich@us.ibm.com

1 - INFORMS Data Mining Contest

Claudia Perlich, Research Staff, IBM T.J. Watson Research Center, P. O. Box 218, Yorktown Heights, NY, 10598, United States of America, perlich@us.ibm.com

We will present the results of the second annual INFORMS data mining contest (http://www.informsdmcontest2009.org/). The two tasks for this year's contest are: 1) modeling of a patient transfer guideline for patients with a severe medical condition from a community hospital setting to tertiary hospital provider and 2) assessment of the severity/risk of death of a patient's condition. For further information and motivation on the healthcare objectives see the background.

■ TD09

C-Room 25A, Upper Level

Scheduling Issues in Computer Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Adam Wierman, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, adamw@caltech.edu

1 - Scheduling to Balance Energy and Delay

Adam Wierman, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, adamw@caltech.edu

Energy usage of computer communications systems has quickly become a vital design consideration. One effective method for reducing energy consumption is dynamic speed scaling, which adapts the processing speed to the current workload. This work studies how to optimally scale speed to balance mean delay and mean energy consumption and how this speed scaling interacts with scheduling policy used.

2 - Queuing and Scheduling for Information Delivery

Tara Javidi, UCSD, 9500 Gilman Dr., La Jolla, CA, 92093, United States of America, tara@ece.ucsd.edu

Historically, the design of data networks has benefited from advances in queuing theory. The drive to achieve maximum efficiency in the networks, however, requires novel generalizations of classical queuing problems. The generalizations are due to the extension of the scheduling functionality across many layers, manipulating the information theoretic structure of data packets. In this talk, we will review some interesting examples of this interplay between information and queuing theories.

3 - Optimal Job Fragmentation on an Unreliable Server

Jayakrishnan Nair, Graduate student, California Institute of Technology, 1200 E California Blvd, MC 256-80, Pasadena, CA, 91125, United States of America, ujk@caltech.edu, Steven Low

Consider a server that alternates between states of availability and unavailability as per a semi-Markov process. When the server becomes unavailable, the job being processed needs to be restarted. For this system, we consider the problem of optimal job fragmentation so as to minimize the expected processing time T. It been proved recently that without fragmentation, T can be heavy-tailed even when the job size distribution is light-tailed. We show that fragmentation can alleviate this problem.

■ TD10

C-Room 25B, Upper Level

Stochastic Inventory and Related Models

Sponsor: Applied Probability
Sponsored Session

Chair: Marty Reiman, Alcatel-Lucent Bell Labs, 600 Mountain Ave., Murray Hill, NJ, United States of America, marty@research.bell-labs.com

1 - Hospital Capacity Effects on Inbound Ambulance Traffic

Paul Enders, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, penders@cmu.edu, Alan Scheller-Wolf, Soo-Haeng Cho, Masha Shunko

Emergency Department (ED) demand originates from two sources: walk-ins and ambulances. Demand for ED services regularly, but temporarily, exceeds supply. During these periods of crowding, adequate care still needs to be provided. The ability to provide care during periods of peak demand depends on the capacities of the ED, the underlying hospital, and nearby EDs. We investigate when, and whereto, ambulances should be diverted to surrounding EDs in case of a supply-demand mismatch.

2 - Global Dual Sourcing: Tailored Base Surge Allocation to Near and Offshore Production

Jan Van Mieghem, Professor, Kellogg-Northwestern University, MEDS dept, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, vanmieghem@kellogg.northwestern.edu, Gad Allon

We analyze a tailored base-surge (TBS) sourcing policy that replenishes at a constant rate from the offshore source and produces at the near shore plant only when inventory is below a target. We present performance bounds on the optimal cost and prove that economic optimization brings the system in heavy traffic. We determine the allocation of random demand into base and surge capacity, estimate corresponding working capital requirements, and identify and value the key drivers of dual sourcing.

3 - Replenishment and Redistribution in Supply Networks

David Yao, Professor, Columbia University, IEOR Dept, New York, NY, United States of America, yao@columbia.edu

We demonstrate that two decisions in a wide range of supply networks, the initial replenishment quantities and the in-period redistribution necessitated by supply-demand imbalance, contribute to the overall value function in qualitatively different ways, with a separation of scales: the contribution of the former is in the order of the demand rate; whereas that of the latter is in the lesser, square-root order of the demand rate. (Joint work with Yongbo Xiao, Tsinghua University.)

4 - Applying the Newsvendor Network Model to Assemble-to-Order Inventory Problems

Qiong Wang, Bell Labs, Alcatel-Lucent, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, qwang@research.bell-labs.com, Marty Reiman

The Newsvendor Network (NN) Model is a special stochastic program that applies to a two-stage production planning problem. The Assemble-to-Order (ATO) inventory model is a multi-period system that is known to be hard to optimally control. We introduce a variation of the NN model that is asymptotically equivalent to the original version and discuss the use of its optimal solution in the development of inventory policies in some ATO systems.

■ TD11

C-Room 25C, Upper Level

Queueing Models-Session

Cluster: Queueing Models
Invited Session

Chair: Robert Hampshire, Carnegie Mellon University, 4800 Forbes Ave, Pittsburgh, United States of America, hamp@cmu.edu

1 - A Queueing Model for Parking-induced Cruising Behavior

Katsunobu Sasanuma, PhD Student, Heinz College, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, katsasa@gmail.com, Richard Larson

We analyze parking-induced cruising behavior quantitatively using a queueing model with reneging. We investigate the stationary distribution of the system and present closed-form asymptotic expressions for some performance indices that capture the level of cruising traffic. We empirically evaluate these indices to reveal the seriousness of cruising congestion.

2 - A Spatial Queueing Model of a Large-scale Bike Sharing Program
Robert Hampshire, Carnegie Mellon University, 4800 Forbes Ave, Pittsburgh, United States of America, hamp@cmu.edu

We develop a spatial queueing model for large scale bike/car sharing services. Our motivating example is the Velib biking sharing program in Paris, which has 20,000 bikes and 1500 bike stations. Over 50 million trips have been taken on Velib bikes since its inception in 2007. Finally, we compare our approximate model to data from the Velib system.

3 - Priority Scheduling for Weighted Processor Sharing Queues
William Massey, Princeton University, Princeton, NJ, 08544, United States of America, wmassey@Princeton.EDU, Robert Hampshire

Through asymptotic scaling we can derive fluid and diffusion approximations for a weighted processor sharing queue. An analysis of the fluid model suggests a profit optimal scheduling policy for this system with the constraint that each customer class has access to the processor a given percentage of the time. We can show how this generalizes the c-mu rule.

4 - Admission and Termination Control of a Two Class Loss System
Mehmet Yasin Ulukus, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, myu1@pitt.edu, Refik Gullu, Lerzan Ormeci

We consider admission-termination control policies in a Markovian loss system with two classes, each with a fixed reward and termination cost, an arrival and service rate. An arriving job is either directly admitted or rejected, or admitted by terminating a current job. Given there is an idle server, termination is shown to be a nonoptimal decision. We establish the optimality of threshold-structured policies and identify conditions that ensure whether a class is preferred or strongly-preferred.

■ TD12

C-Room 26A, Upper Level

Locational Analysis and Computing

Sponsor: Computing Society
Sponsored Session

Chair: Tingting Cui, PhD Candidate, University of California Berkeley, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States of America, tingting@ieor.berkeley.edu

1 - Reliable Facility Location under Correlated Disruptions: A Continuum Approximation Approach
Xiaopeng Li, University of Illinois at Urbana-Champaign, 205 North Mathews Ave, B156, Urbana, IL, 61801-2352, United States of America, li28@uiuc.edu, Yanfeng Ouyang

This paper proposes a continuum approximation (CA) model to minimize the expected cost of the reliable uncapacitated fixed charge location problem where facilities are subject to spatially correlated disruptions. The paper presents ways to formulate the correlation among adjacent facility disruptions. Numerical experiments illustrate how the correlations significantly influence the optimal system design.

2 - Approximating the Hub Location Problem
Dongdong Ge, Stanford University, 14 Comstock Cir, Apt 106, Stanford, 94305, United States of America, dongdong@gmail.com, Yinyu Ye, Jiawei Zhang

This work discusses the approximation of the hub location problem(HLP). The work includes 3 parts. First, we investigate the hardness of the HLP and provide the in-approximation. Second, we provide the first constant approximation algorithm for the metric HLP and the first non-trivial approximation algorithm for the general case. Finally the computational results with the implementation of different randomized algorithms are analyzed.

3 - Optimization Models for Processing GPS Probe Vehicle Data
Ryan Herring, Ph.D. Candidate, University of California, Berkeley, 2105 Bancroft Way Suite 300, Berkeley, CA, 94720, United States of America, ryanherring@berkeley.edu, Alex Bayen

The number of GPS-enabled cell phones is increasing exponentially providing an abundance of traffic data. We present optimization models for processing this data for providing travel time estimates. In particular, we introduce Mobile Millennium, a pilot project for processing GPS and other data sources into real-time and forecasted traffic conditions.

4 - Two-Stage Facility Location Problem with Second-Stage Activation Costs
Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com, John Penuel

We study a stochastic facility location problem where facilities must first be located, then activated before they can satisfy scenario demands. Fixed charges arise in the location of the facilities, and then in their activation. Hence, integer variables are present in both stages of the problem. We derive cutting planes by solving a series of specialized shortest path problems based on a modified residual graph from the recourse solution.

■ TD13

C-Room 26B, Upper Level

Optimization in Practice VI - Health Care

Sponsor: Computing Society
Sponsored Session

Chair: Don Kleinmuntz, Executive Vice President, Strata Decision Technology LLC, 2001 S First St., STE 200, Champaign, IL, 61820, United States of America, dnk@strata-decision.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Implementing Enterprise-wide Capital Resource Optimization in Hospitals and Health Systems
Don Kleinmuntz, Executive Vice President, Strata Decision Technology LLC, 2001 S First St., STE 200, Champaign, IL, 61820, United States of America, dnk@strata-decision.com

Most U.S. hospitals and healthcare systems are mission-focused organizations that balance service quantity and quality against financial needs. This presentation will describe a multi-criteria decision analytic model for optimal capital allocation that has been implemented in hundreds of hospitals. The discussion will emphasize implementation challenges in these organizations.

2 - Optimization in the Scheduling of Breast Cancer Treatments
Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

In many cases, the diagnosis and/or treatment of breast cancer patients are in multi-step procedures with strict time constraints. For example, the chemotherapy is delivered in a sequence of treatments over a period of time. The optimization in the scheduling of breast cancer treatments is part of a comprehensive treatment management system with effectiveness and efficiency as its goals. To the least, it improves patients' waiting times and healthcare resource usages.

3 - A Software Suite for Public Health, Disaster Medicine and Emergency Response
Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu, Chien-Hung Chen

RealOpt© is a software enterprise system developed by Lee and her research team. It consists of decision support capabilities for modeling and optimizing the public health infrastructure for all hazard emergency response. It has been used in biological or radiological terrorism preparedness, infectious disease outbreaks planning, and natural disasters response. We will describe the various decision support modules, their designs and practical usage. This work is joint with CDC.

■ TD14

C-Room 27A, Upper Level

Genome Variation Analysis

Sponsor: Computing Society
Sponsored Session

Chair: Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu

1 - Estimating Local Ancestries From Genetic Information
Bogdan Pasaniuc, International Computer Science Insititute, 1947 Center St., Berkeley, CA, 94704, United States of America, bogdan@ICSI.Berkeley.EDU

Accurate inference of the ancestry at each location in the genome of complex human populations (e.g. African-Americans) based on genetic information is a challenging task. In this talk I am going to present accurate and computationally efficient methods for addressing this problem. The relationship between the genetic background of the studied populations and the quality of the local ancestries will also be discussed.

2 - New Approaches to the Decoding of Hidden Markov Models
Dan Brown, Associate Professor, University of Waterloo, David R. Cheriton School of Business, 200 University Ave. W., Waterloo, ON, N2L 3G1, Canada, browndg@uwaterloo.ca

Hidden Markov models are used in a many bioinformatics applications to divide discrete sequences into important features. The common Viterbi algorithm for HMM decoding is used to find the global explanation of maximum likelihood, which may be of low probability and incorrect. We focus on the idea of an HMM dividing a sequence into intervals and develop two alternative methods: one

which seeks a high probability cluster of similar explanations, and another summarizing the k most likely paths.

3 - Reconstruction of Parental Genotype From Microsatellite Data
Saad Sheikh, Department of Computer Science, University of Illinois at Chicago, 851 S Morgan St, (M/C 152), Chicago, IL, 60607, United States of America, ssheik3@uic.edu, W. Art Chaovalitwongse, Tanya Berger-Wolf, Isabel Caballero, Ashfaq Khokhar, Mary Ashley, Chun-An Chou, Bhaskar DasGupta

Kinship Analysis from microsatellite markers is an important area of population genetics with applications in conservation biology, kin selection, evolutionary biology and agriculture. We will discuss the combinatorial problem of reconstructing minimum parents necessary to explain a given cohort of individuals. We will present an Integer Linear Programming solution to the problem and discuss how the problem is related with other problems in kinship analysis and complexity theory.

4 - Applications of Phylogenetic Tree Inference at Genomic Scales
Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu, Guy Blelloch, R. Ravi, Ming-Chi Tsai

This talk will present work on using phylogenetic tree inferences across many local regions of a genome to study evolution from the molecular to the population level. We will first review some prior methods that have made phylogenetics at genomic scales practically possible. We will then see how the resulting genome-scale phylogeny data sets can help us solve important problems in population genetics, such as population substructure analysis and genotype/phenotype association testing.

■ TD15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Lyzasoft, Inc. - Prep Your Data with Lyza – Get into the Heart of Your Modeling Faster
Brian Krasovec, Founder & CTO, Lyzasoft, Inc., 1675 Broadway, Suite 1300, Denver, CO, 80202, United States of America

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

2 - Syncopation Software - DPL: Powerful Decision Analytics
Chris Dalton, CEO, Syncopation Software, Inc., 1623 Main Street, Concord, MA, 01742, United States of America, cdalton@syncopation.com

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

■ TD16

C-Room 28A, Upper Level

Contracts and Sourcing

Sponsor: Information Systems
Sponsored Session

Chair: Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu

1 - Flexibility, Rent Seeking and Control Rights in Contracting
Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu

We examine the role of hazard equilibration and rent seeking in contract design. The design of control rights in contracts could prevent parties from exploit contract incompleteness to appropriate rents. Further, outside options of parties strengthen incentives for specific investments, and thereby solves the holdup problem.

2 - Contract Flexibility and Negotiator Incentives
Eric Walden, Associate Professor, Texas Tech University, 19th Street, Lubbock, TX, 79409, United States of America, eric@ericwalden.net, Tridas Mukhopadhyay

IT outsourcing contracts are plagued by inflexibility. Using tournament theory we develop an economic model to explain how the contract negotiator's incentives influence contract flexibility. We show that neither wage nor commission gives any preference for flexibility. However, a promotion incentive does give the negotiator a preference for less flexible contracts. The preference for less flexible contracts is increasing in discount rate and in the number of competitors for the promotion.

3 - Global Multisourcing Strategy: What IT Services Research Can Learn From Manufacturing
Natalia Levina, Associate Professor, NYU, Kaufman Management Center, 44 West 4th Street, Room 8-78, New York, NY, 10012, United States of America, nlevina@stern.nyu.edu, Ning Su

"Multisourcing" is an emerging strategy in global IT services outsourcing. A central component of this strategy is combining services from multiple vendors to achieve optimal business outcome. A similar concept, supply base management, has been extensively examined by operations management scholars in the context of manufacturing. Here we examine the research on manufacturing to provide insights into tradeoffs involved in the use of multiple vendors in IT services multisourcing.

■ TD17

C-Room 28B, Upper Level

Security Challenges in e-Business Environment

Sponsor: e-Business
Sponsored Session

Chair: Byung Cho Kim, Assistant Professor, Virginia Tech, Business Information Technology, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu

1 - Internet Security: A Comparative Analysis of Liability Policy
Terrence August, Assistant Professor, UCSD, Rady School of Management, 9500 Gilman Drive, MC 0553, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu, Tunay Tunca

We study the effectiveness of vendor software security liability mechanisms under network externalities. We compare mechanisms that require a vendor to partially reimburse either users who incur patching costs or those who incur losses from security attacks, some of which are unpatchable zero-day events. We analyze these proposed liability schemes holding the security level of a software product fixed and then extend analysis to permit security investment by the vendor in response to liability.

2 - Vendor Information Risk Rating
M. Eric Johnson, Professor, Dartmouth College, Tuck School of Business, 100 Tuck Hall, Hanover, NH, 03755, United States of America, M.Eric.Johnson@tuck.dartmouth.edu, Zach Zhou

Vendors represent an important source of information risk. Recently there have been several industry led initiatives to create vendor risk ratings. Using a vertical differentiation framework, we model the impact of such ratings on vendor competition.

3 - Security vs. Convenience? An Experimental Study of User Misperceptions of Wireless Internet Service
Byung Cho Kim, Assistant Professor, Virginia Tech, Business Information Technology, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu, Yong-Wan Park

This study demonstrates that consumers make incorrect inferences about the relationship between security and convenience. We conduct three experiments to examine user perceptions of wireless Internet service quality. Our results indicate that users believe in improving security in return for losing convenience, although advanced technology can achieve both.

4 - Risk Management Issues in E-Business
Soumyo Moitra, Senior MTS, CERT/SEI, Carnegie Mellon, 4500 Forbes Ave, Pittsburgh, PA, 15213, United States of America, sdmoitra@hotmail.com

This paper discusses issues in risk management for e-business. It develops a model for costs and benefits of e-operations given the risk of Internet crime. The optimal balance lies in having enough security measures to reassure customers and business partners while at the same time not make the security system too onerous for users.

■ TD18

C-Room 28C, Upper Level

Wireless Networks 1

Sponsor: Telecommunications
Sponsored Session

Chair: Timothy Matis, Texas Tech University, Department of Industrial Engineering, Box 43061, Lubbock, TX, 79409, United States of America, timothy.matis@ttu.edu

1 - Epidemic-based Information Dissemination in Wireless Mobile Sensor Networks

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

We consider wireless mobile sensor networks under extreme environments. The limitation on computational power and energy of nodes forces us to consider explicit stopping criteria for information spread. The objective of this paper is to characterize the dynamics of the information spread and obtain performance measures based on stochastic modeling. We start with modeling information flow using a Markov chain and then relax the inter-transmission time distribution.

2 - Optimal Resource Replication in Query-Based Wireless Sensor Networks

Jeffrey Kharoufeh, Associate Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, jkharouf@pitt.edu, Guvenc Degirmenci

We develop and analyze a queueing model to evaluate resource replication strategies in query-based wireless sensor networks. Subsequently, we formulate and solve an optimization problem to select the resource replication level that minimizes an aggregate measure of network energy expenditure.

3 - A Cutting Plane Algorithm for Solving the Large-scale Broadband Convergence Network Design Problem

Gigyoung Park, Korea University, Sungbuk Ku Anam Dong 5-1, Seoul, Korea, Republic of, shadowpp@korea.ac.kr, Sunseok Lee, Noik Park, Youngwook Kim, Youngho Lee

We present an exact algorithm for solving a large scale network design problem of broadband convergence access networks. We formulate the problem as a three level hierarchical location-allocation model with nonlinear QoS constraints. We present promising computational results of the new disjunctive cuts that significantly enhance LP lower bounds.

4 - Fundamentals of Wireless Network Research

Timothy Matis, Texas Tech University, Dept of Industrial Engineering, Box 43061, Lubbock, TX, 79409, United States of America, timothy.matis@ttu.edu

The OR community has developed several models related to optimizing the QoS of wireless networks over the past several years. Notwithstanding, many of these ignore fundamental aximoms related to the physical transmission of a wireless signal. In this presentation, we consider several of these axioms, and comment on how several OR models could be improved to increase fidelity.

■ TD19

C-Room 28D, Upper Level

Tutorial: Warehouse Design and Open Research Issues

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu

1 - Operations Research in Warehouse Design

Leon McGinnis, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, leon.mcginnis@isye.gatech.edu, Russell Meller

This tutorial will address the question: "Of what practical value is OR in warehouse design?" The panelists will begin by discussing "real" warehouse design, and the role of OR — especially computational models — in the warehouse design process. The discussion will then turn to opportunities for both interesting OR research and practical OR applications in warehouse design.

■ TD20

C-Room 28E, Upper Level

Supply Chain Design

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Nizar Zaarour, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zaarour.n@neu.edu

1 - An MIP Reverse Logistics Network Model for Product Returns

Nizar Zaarour, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, zaarour.n@neu.edu, Emanuel Melachrinoudis, Marius Solomon, Hokey Min

An MIP model for the reverse logistics network of product returns is presented and analyzed. The special problem structure, consisting of one initial collection point and one centralized return center is modeled and solved for the best tradeoff between inventory carrying costs and shipping costs. Key words: Reverse logistics, consolidation, network design

2 - Transportation and Inventory Trade-offs in Multiperiod Distribution System Models

Debra O'Connor, Assistant Professor, College of the Holy Cross, One College Street, Worcester, MA, 01610, United States of America, doconnor@holycross.edu, Agha Iqbal Ali

Two determinants of computational intractability of multiperiod distribution models are the spatial characteristics, and the trade-off between transportation and inventory costs. This paper develops echelon-flow-based valid inequalities using truckload-equivalents of required flows, and aggregated variable reduction based on truck-load-inventory-value to strengthen the underlying relaxation. Computational testing reveals that the strengthened model can reduce the duality gap by up to 99%.

3 - Effects of Advance Demand Information on Supply Chain Order Stability: An Experimental Study

Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 1209 Newmark Laboratory, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, yfouyang@illinois.edu, Onur Pekcan, Baris Aktemur

Many supply chains are known to suffer from the bullwhip effect; i.e., fluctuations in order sequences are usually larger for suppliers farther away from the customer. This talk presents an unstructured experimental study which demonstrates the potential to stabilize supply chain order sequences with advance demand information strategies. The experiments are carried out using a new Internet-based computer game where the operations of a multi-stage serial supply chain are simulated by players.

■ TD21

C-Room 30B, Upper Level

Emerging Areas: Transportation and Biofuels

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Seungmo Kang, University of Illinois at Urbana-Champaign, Room 1115, 1206 West Gregory Drive, MC-195, Urbana, IL, 61801, United States of America, skang2@illinois.edu

1 - Biofuel Refinery Location and Biomass Transportation Planning

Yun Bai, University of Illinois at Urbana-Champaign, B156 Newmark CE Lab, 205 N Mathews,M/C 250, Urbana, IL, 61801, United States of America, yunbai1@illinois.edu, Seungmo Kang, Yanfeng Ouyang, Taesung Hwang

This research focuses on planning biofuel refinery locations where the total system cost for refinery construction and biomass transportation is minimized. Biomass shipment routing and the resulting traffic congestion are incorporated into the decision on refinery locations. A Lagrangian relaxation based heuristic algorithm is integrated within a branch and bound framework to solve the proposed model. Numerical examples will also be presented.

2 - Multi-Period Facility Location Model for Optimizing the Bioethanol Infrastructure

Seungmo Kang, University of Illinois at Urbana-Champaign, Room 1115, 1206 West Gregory Drive, MC-195, Urbana, IL, 61801, United States of America, skang2@illinois.edu, Yanfeng Ouyang, Jürgen Scheffran, Hayri Onal, ‹. Deniz Tursun

This research presents a mathematical programming model and a case study for determining optimal locations and capacities of biorefineries, delivery of bioenergy crops, and processing and distribution of both ethanol and co-products (DDGS). The model aims to minimize total system costs in a multi-year planning horizon for both corm and cellulose based biorefineries.

■ TD22

C-Room 30C, Upper Level

Air Traffic Management

Contributed Session

Chair: Alex Nguyen, University of Maryland, 2247 A.V. Williams Building, College Park, MD, 20724, United States of America, alexatn@umd.edu

1 - An Integrated Traffic Flow Management Design Tool
George Hunter, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States of America, nwenderl@sensis.com, Krishnakumar Ramamoorthy

The traffic flow management problem is intimately related to the system demand, and has implications for the environmental impact and the cost of system upgrades and operation. Here we present an integrated analysis and design tool that leverages aggregate-level models for demand, traffic flow management, environmental impact and costs. We focus on the traffic flow management aggregate model.

2 - Predicting Sector Transit Times to Support Adaptive Eulerian Traffic Flow Modeling
Aditya Saraf, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States of America, Aditya.Saraf@Sensis.com, Peter Yu, David Rappaport, Katy Griffin

Deriving aggregate (Eulerian) air-traffic flow models requires accurate prediction of future control-volume aircraft counts. This paper presents a method for accurate prediction of sector transit time and sector aircraft counts as a function of sector geometry, sector traffic pattern, sector aircraft count, weather in the sector, aircraft-type and other factors.

3 - Commercial Air Travel Network: An Inventory Approach
Dipasis Bhadra, Senior Economist, FAA/DOT, 800 Independence Avenue, Washington, DC, DC, 20591, United States of America, dipasis.bhadra@faa.gov

How did air traffic network evolve in the US over time? Are the changes transitory or permanent; systematic or random? By creating an inventory of observed networks over time, we put forward a simple pattern recognition model that establishes the links between observed network now and those in the past. This simple framework can be used for understanding air traffic network with respect to size of the markets, types of competition, geospatial features, and structural changes.

4 - Very Light Jets Provide Opportunities for Changing the Business Travel Market
Dennis Mathaisel, Professor, Babson College, Babson Hall, Babson Park, MA, 02457-0310, United States of America, mathaisel@babson.edu, Clare Comm

Very Light Jets provide a personal, direct, on-demand, air taxi service to the business traveler. This paper presents an approach on how to change the behavior of the business traveler to use this service and an innovative technique for optimally scheduling the service to minimize costs.

5 - Network Cell Air Traffic Routing Model for Control of Throughput and Delay
Alex Nguyen, University of Maryland, 2247 A.V. Williams Building, College Park, MD, 20724, United States of America, alexatn@umd.edu, John Baras

We propose a new approach in leveraging the highway cell transmission model (CTM) to the airspace in the form of a multiobjective optimization that trades between maximizing throughput and minimizing delay. The main flows of air traffic are determined via a clustering method and converted into a network of cells. The model is a multicommodity traffic flow Integer Program where the constraints are relaxed slightly from the CTM to examine strategies for achieving optimal throughput and delay.

■ TD23

C-Room 30D, Upper Level

Simulation of Military Systems

Sponsor: Military Applications Society
Sponsored Session

Chair: Rob Kewley, Director, Operations Research Center, West Point Dept of Systems Engineering, 4th Floor Mahan Hall, West Point, NY, 10996, United States of America, robert.kewley@usma.edu

1 - Marine Corps Systems Command TLCSM Discrete Event Modeling and Simulation Tool
Stephen Mount, Major, Marine Corps Systems Command, 2200 Lester Street, Quantico, Va, 22134, United States of America, stephen.mount@usmc.mil, Thomas Turner

Marine Corps Systems Command has recognized the need to make Total Life Cycle Systems Management (TLCSM) decisions based upon readily available, web-based, maintenance and availability data. Using Microsoft Excel and the ExtendSim modeling environment, a flexible and modular model was developed to provide Program Managers with insight into the implications associated with different operational supply chain management and business case decisions as they relate to a particular weapons system.

2 - A Simulation Study of Stochastic Combat Networks
Yoon G Hong, Professor, Hansung University, 38, 2-Ga Samseon-dong Sungbuk-gu, Seoul, 136-792, Korea, Republic of, yhong@hansung.ac.kr, Hyun J Min

As military technology has developed, military analysts have growing interest in combat network systems. This study considers two different force moving rules to express a more realistic situation in the analysis of mini-battle network problems. The results are compared to the existing models. This study suggests some further works which need to be investigated. These include force allocation, moving speed, tactics, weather, and topography, etc.

3 - A Strategic Capability-based Force Structure Simulation
Alex Bourque, Defence Research and Development Canada, 101 Colonel By Drive, Ottawa, ON, K1A 0K2, Canada, alex.bourque@drdc-rddc.gc.ca, Cheryl Eisler

Tyche is a discrete-event Monte Carlo scheduling simulation tool developed to carry out joint force structure analysis within the Canadian military context. Fleets of assets are tested against a future security environment, and matching between the demand and the supply is done by using capabilities. Several constraints including personnel tempo can be factored in. This presentation describes the salient features of Tyche and how it can be used for force structure analysis.

■ TD25

C-Room 31A, Upper Level

Optimization Models in Air Traffic Flow Management

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Michael Ball, Robert H Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, mball@rhsmith.umd.edu

1 - Fairness in Air Traffic Flow Management
Shubham Gupta, PhD Student, M.I.T, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, shubhamg@MIT.EDU, Dimitris Bertsimas

We study fairness in Air Traffic Flow Management (ATFM). The existing models for ATFM do not impose controls on the number of pairwise reversals and the distribution of delays across airlines. We formulate these two ``fairness" controls as integer programming models. Moreover, we provide empirical results of the proposed optimization models on real world, national-scale datasets spanning across six days that illustrate that the proposed models successfully address these ``fairness issues".

2 - Departure Runway Management with Queue Assignment
Gautam Gupta, Associate Research Scientist, University Affliliated Research Center, Building 210, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States of America, ggupta@ucsc.edu, Waqar Malik, Yoon Jung

A mixed integer linear program for departure runway management is developed. The model does runway queue management and schedules departure aircraft as well as arrival aircraft runway crossing to maximize runway throughput. The model incorporates (optional) prioritization of certain departing aircraft and different methods of queue management (first in first out, dedicated lane for high priority flights and others). We present computational results and implementation methods under uncertainty.

3 - Optimal Selection of Airport Runway Configurations
Michael Frankovich, Graduate Student, MIT, 77 Massachusetts Ave, Building E40-149, Cambridge, MA, 02139, United States of America, mfrankov@MIT.EDU, Dimitris Bertsimas, Amedeo Odoni

We present a mixed integer programming formulation to solve the problems of (i) selecting an airport's optimal sequence of runway configurations, and (ii) determining the optimal balance of arrivals and departures to be served at any moment. Large realistic problem instances are solved within several minutes. Furthermore, comparison to a baseline heuristic reveals that the potential cost reduction is significant.

4 - Computationally Tractable Stochastic Integer Programming Models for Air Traffic Management
Charles N. Glover, Doctoral Candidate, University of Maryland, 3117 A.V. Williams Building, College Park, MD, 20742, United States of America, cnglover@math.umd.edu, Michael Ball

Convective weather is a major contributor to air traffic delays. There is much uncertainty associated with weather predictions, so stochastic models are necessary to assign ground delay and route adjustments to flights. We describe a multi-period stochastic integer program for this problem. We show that under certain conditions the LP-Relaxation yields integer optimal solutions. For more general cases we compare the strength of alternate formulations and provide tractable formulations.

■ TD26

C-Room 31B, Upper Level

Risk Management in Cost Estimation

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Geoffrey Berlin, Federal Aviation Administration, 1701 Columbia Avenue, College Park, GA, 30337, United States of America, Geoffrey.Berlin@faa.gov

1 - Integrating Cost & Schedule Risk Analysis to Promote Program Success
Eric Druker, Booz Allen Hamilton, 8283 Greensboro Drive, McLean, VA, 22102, United States of America, druker_eric@bah.com, Booz Allen Hamilton

Although undeniably related, cost estimating, schedule estimating and risk management are traditionally practiced as separate functions. Noticing this shortcoming, and desiring to better predict their program's final costs & schedules, agencies such as NASA are beginning to set policy aimed at finally uniting these three, formerly independent, activities. This presentation will discuss the emergent field of integrated cost & schedule risk analysis. It will begin with a discussion of the reasons for this integration and the process by which it is accomplished. It will then focus on the general integration methodology, including how the cost estimate, integrated master schedule and risk management plan are united in the analysis and what tools and methods are utilized to analyze risk. The presentation will conclude with a primer on how program managers can use the results of the integrated risk analysis to: better understand the relationship between cost and schedule on their program, prioritize and mitigate risks based on their cost and schedule impacts and develop and defend contingency (or reserve) positions to ensure that programs have a high probability of coming in at cost and schedule.

2 - Balancing Risk in FAA's Estimating Process for Flight Inspection Costs
Geoffrey Berlin, Federal Aviation Administration, 1701 Columbia Avenue, College Park, GA, 30337, United States of America, Geoffrey.Berlin@faa.gov

The most conservative approach to estimating a cost is to consider the most costly, or worst case estimate. This approach almost guarantees that a project will always be completed within budget. However, this approach also leads to inefficient use of governmental funds and significantly limits the number of projects that will be initiated in any given year. An example of the FAA's initiative to promote efficient allocation of financial resources is the Flight Inspection Model. The flight inspection cost model assists in estimating the cost of a commissioning type flight inspection of an Instrument Landing System (ILS). The model is based upon statistics derived from historical flight inspection times incurred by the FAA's Flight Inspection Operations Group. These statistics showed that the flight inspection times for all ILS components closely followed a Gamma probability distribution. The cost model uses these statistics and the Gamma distribution as the basis for generating risk adjusted estimates. The model generates a risk adjusted estimate of the flight time required to complete a flight inspection of an ILS.

3 - Making Statistical Analysis Accessible: The RAMS Tool for Performing Regression and Risk Analysis
Matt Lytton, Booz Allen Hamilton, 8283 Greensboro Drive, McLean, VA, 22102, United States of America, Lytton_Matthew@bah.com, Eric Druker, Booz Allen Hamilton, Gregory Hogan

Early on in program development it is generally the case that cost and schedule are predicted based on high-level parametric estimates. Despite this being the phase where the least is known about the program, it is more often than not the point in time at which future budgets are developed. Because of this fact, it is vitally important that the most robust cost and schedule estimating techniques be utilized. Cost and schedule estimating relationships (CERs and SERs) are regression equations, derived using statistical analysis, used to predict cost and schedule based on a program's technical parameters. Many of the common tools for developing CERs and SERs (such as Microsoft Excel) contain the functionality required to perform statistical analysis, but without any context required to interpret the results. To this end, Booz Allen has developed the Regression & Risk Analysis Methodology Streamliner (RAMS tool). The RAMS tool automates regression analysis for the development of CERs and SERs including features that explain the results and how they relate to the cost estimate. Additionally, it takes estimates developed using these CERs and SERs and automatically converts them into risk distributions. This integrating of cost estimating and risk analysis allows program managers to make budgeting decisions that will help ensure their program has adequate reserves to cover future cost and schedule growth.

4 - Tools, Data, and Results for Estimating Risk in Lifecycle Cost Estimates
Mike Shoecraft, Cost Analyst, SPAWAR 1.6, Space and Naval Warfare Systems Command, 4301 Pacific Hwy, San Diego, CA, 92110, United States of America, Mike.Shoecraft@navy.mil

The Weapon System Acquisition Reform Act of 2009 requires Major Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAISs) to justify the selection of a confidence level of less than 80% for their cost estimates. This presentation provides several tools, data, and results for estimating cost risk for lifecycle costs for large software development efforts within the Space & Naval Warfare Systems Command.

■ TD27

C-Room 31C, Upper Level

Simulation Optimization I

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Leyuan Shi, Professor, University of Wisconsin-Madison, 3250 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, leyuan@engr.wisc.edu

1 - Simulation Optimization Using COMPASS in High Dimensions
Barry L Nelson, Professor, Northwestern University, Department of Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu, Jie Xu

Convergent optimization via most promising area stochastic search (COMPASS), and its implementation in Industrial Strength COMPASS (ISC), is designed to converge with probability 1 to a locally optimal solution for stochastic simulation optimization problems with integer-ordered decision variables. We describe and evaluate enhancements of ISC to make it more efficient for higher dimensional decision variables.

2 - Monte Carlo Inference for Stochastic Root Finding
Raghu Pasupathy, Assistant Professor, Virginia Tech, 221 Durham Hall, Blacksburg, VA, 24061, pasupath@vt.edu

Our broad focus in this talk is Monte Carlo inference for sample average approximation (SAA) estimators within stochastic root finding problems (SRFPs). Some specific questions we tackle include: (i) when and at what rate do SAA solutions to SRFPs converge? (ii) what is the complexity of stochastic root finding? (iii) can minimum sample size rules and sequential sampling schemes be devised to identify solutions of a specified quality? Key results are illustrated through a numerical example.

3 - Nested Partitions with Statistical Promising Indices
Weiwei Chen, Student, University of Wisconsin-Madison, 3247 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, wchen26@wisc.edu, Leyuan Shi, Zhengjun Zhang

Nested Partitions (NP) is a partitioning and sampling-based algorithm for large-scale optimization. It guides the search on the promising regions, determined by promising indices. We propose statistical promising indices for NP. It can speed up the algorithm, and be used to estimate the success probabilities of NP moves, which are useful in determining a good algorithm setting. Statistical bounds can be obtained, when theoretical bounds are not effective. Numerical examples show good results.

4 - The Instance Risk of Simulation-Based Optimization Algorithms
Qing-Shan Jia, Tsinghua University, Beijing, 100084, China, jiaqs@tsinghua.edu.cn, Qianchuan Zhao

Most previous simulation-based stochastic optimization algorithms focus on the average performance of these algorithms over multiple runs. In this paper we make a first study on the instance risk which measures the risk for an algorithm to output a set of nonsatisfactory designs after a single run on a single problem instance. This instance risk is of great practical interest when each simulation is time-consuming.

5 - Can OR be Used to Optimize Business Strategy? Stochastic Optimization Might Hold the Key
Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Strategic planning decisions are not easily modeled with classic optimization techniques. Using agent-based Monte Carlo simulation, stochastic optimization, and grid computing, Vanguard Software built a drug development pipeline model

for Novartis Vaccines & Diagnostics which forecasts performance and optimizes the acquisition schedule for new drugs. In this presentation, we discuss lessons learned and practical issues such as designing consensus objective functions and communicating results.

■ TD28

H-Room 500, Fifth Floor

Non-parametric Data-Driven Methods in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Huseyin Topaloglu, Cornell University, School of ORIE, Rhodes Hall, Ithaca, NY, 14853, United States of America, ht88@cornell.edu

1 - Stochastic Approximation for Computing Bid Prices for Overbooking over an Airline Network

Huseyin Topaloglu, Cornell University, School of ORIE, Rhodes Hall, Ithaca, NY, 14853, United States of America, ht88@cornell.edu, Sumit Kunnumkal

We present a stochastic approximation method to find a good bid price policy for making overbooking decisions over an airline network. Our approach views the total expected profit as a function of the bid prices and uses sampled derivates of the total expected profit to find a good set of bid prices. We present comparisons with standard benchmark methods and demonstrate substantial profit improvements.

2 - Computing Bid-prices for Revenue Management under Customer Choice Behavior

Gustavo Vulcano, Assistant Professor, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Juan Chaneton

We develop a stochastic approximation algorithm to compute bid prices for network revenue management, accounting explicitly for choice behavior effects. One of the main practical advantages of this proposal is that it can be built-in as an extra layer on current RM systems that implement bid-price controls. Our numerical experiments show that the approach has interesting potential from a revenue performance perspective.

3 - Mining Sales Person Decisions in Pricing

Itir Karaesmen, University of Maryland, 4357 Van Munchin Hall, College Park, MD, 20742, United States of America, ikaraes@rhsmith.umd.edu, Wolfgang Jank, Wedad Elmaghraby, Shu Zhang

In many B2B transactions, sales persons have significant responsibility in pricing decisions. Using a data set from a grocery products manufacturer, we study how sales people adjust price quotes for different products and different customers over time. We investigate what factors influence price adjustments and build a model to predict these price changes.

4 - The Pricing of Innovative Products with Upgrading and Advertising Decisions

Kevin D. Ferreira, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ferreira@mie.utoronto.ca, Chi Guhn Lee

We examine how a firm can use dynamic pricing, advertising, and upgrading decisions to influence how customers value their product; and how its acceptance diffuses throughout the market so that profits are maximized. We utilize a risk-adjusted, multi-attribute utility function to model the customer's valuation of the product, which is updated using a multi-source Bayesian approach. The likelihood that a customer will purchase the firm's product is formulated using discrete choice theory.

■ TD29

H-Room 501, Fifth Floor

Options Pricing in Energy Market

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

Chair: Jieyun Zhou, Graduate Student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, jzhou@isye.gatech.edu

1 - A Fourier Transform Method for Pricing Options under Mean-reverting Pure Jump Processes

Li Xu, Graduate student, Goergia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30332, United States of America, lxu@gatech.edu, Tony Ware

Energy commodities, such as oil, gas and electricity, exhibit high volatilities, sudden jumps and long-run mean-reversion. We proposed a Fourier transform based method with semi-Lagrangian time stepping to evaluate European and American type contingent claims written on mean-reverting Levy-driven assets. The algorithm involves fast Fourier transform on non-equally spaced points and is applicable to any Levy processes. We carry out a numerical example of pricing put options under OU-VG processes.

2 - Empirical Analysis of Implied Volatility in the Nordic Electricity Market

Johan Sollie, Research Fellow, NTNU Norway, Department Industrial Econ and Technology Mgmt., Trondheim, NO-7491, Norway, johan.sollie@iot.ntnu.no, Stein-Erik Fleten, Magnus Muri Boberg, Andreas Lindal

In this article we investigate the relationship between implied volatility of traded options and observed volatility in the Nordic electricity market. We find that implied volatility preforms well as forecast of future volatility. The performance of Implied volatility is compared to other forecasts of volatility such as GARCH type models.

3 - Real Options Valuation for Natural Gas Storage

Jieyun Zhou, Graduate student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, jzhou@isye.gatech.edu, Shi-Jie Deng, Sandeep Jain

We propose a market-based valuation framework for valuing natural gas storage facility with realistic operational characteristics. We develop a fast and accurate numerical scheme to solve for the dynamically optimal spot trading strategy. Furthermore, we propose to value a storage based on a trading strategy which consists of both spot and forward tradings, thus improving the storage valuation by accounting for the inter-month and intra-month operation flexibilities.

■ TD30

H-Room 502, Fifth Floor

Energy I

Contributed Session

Chair: Joahnna Amaya, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, jamaya@ufl.edu

1 - Integer Programming and Network Flow Approaches for Solving Gas Transmission Problem

Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, andynfan@ufl.edu, Qipeng Zheng, Panos Pardalos

In this talk, the gas transmission problem is solved in the approaches of binary integer programming and some techniques from network flow optimization. Some numerical results and comparisons with other methods are also presented.

2 - An Overview of Algorithms and Models for Transmission Network Expansion Planning

Alexey Sorokin, University of Florida, 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States of America, sorokin@ufl.edu, Panos Pardalos, Steffen Rebennack

The Transmission Network Expansion Planning (TNEP) problem answers in an optimal way where new electricity circuits should be built and to what nodes new electricity lines should be connected in order to satisfy the forecasted demand. We present the state-of-the-art in TNEP modeling and solution techniques. Among these techniques are exact methods like linear and nonlinear programming, MIP and Benders decomposition as well as heuristic approaches such as GA and GRASP.

3 - Modeling Oil Supply Disruption Risk Using EVT and Copula

Kabir Katata, Doctoral Researcher, Warwick Business School, University of Warwick, Coventry, CV4 7AL, United Kingdom, kabir.katata07@phd.wbs.ac.uk, Nalan Gulpinar

Reliable quantitative analysis of oil supply disruptions is essential for governments and oil traders. Presently,disruption risk is not measured and therefore not insured.Oil supply disruptions are extreme events that can be rare and severe. We model the disruptive events and quantify the associated financial loss arising from such disruptions using extreme value theory (EVT).We also investigate the behaviour of oil and gas supply disruptions by considering their joint impact using copula.

4 - Updated Energy Balance Towards Optimization

Joahnna Amaya, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, jamaya@ufl.edu, Cristiàn Càrdenas

We present a study of both an initial and an updated energy balance resulting from an industrial energy audit. The new energy consumption and costs are presented to show associated savings. A numerical example is offered as a proof of this statement, with an optimization model. Further work is discussed.

■ TD31

H-Room 503, Fifth Floor

Pricing Under Uncertainty

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Javad Nasiry, Ph. D. Student, INSEAD, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Javad.NASIRY@insead.edu

1 - Pricing Access Services

Ozge Sahin, Assistant Professor, University of Michigan, Stephen M Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, ozge@bus.umich.edu, Guillermo Gallego

We consider how consumer's uncertainty in the valuations and the amount they will consume impact the demand over time and how the firm can exploit consumer's uncertainty in pricing decisions. We investigate the optimal structure of the contracts that a firm should offer in industries that charge access fees to consumers. We provide guidelines on pricing access services and warranties if the consumers are facing time inconsistency and have different risk preferences.

2 - Revenue Management for Online Advertising Using Advertising Networks

Sami Najafi-Asadolahi, PhD candidate, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, snajafi.phd2005@london.edu, Kristin Fridgeirsdottir

We consider a web publisher that generates revenues from displaying advertisements on its website. An advertising network supplies the publisher with advertisers that are charged according to the so-called cost-per-impression pricing scheme. We model the publisher's operation as a queueing system where advertising slots correspond to servers. We derive a closed-form solution for the system's steady-state probabilities, determine the optimal price and provide managerial insights.

3 - Advance Selling, Strategic Consumers and Competition

Pnina Feldman, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, pninaf@wharton.upenn.edu, Gerard Cachon

Advance selling has been shown to provide the firm with higher profits than spot selling. We investigate whether this continues to hold when firms compete in an environment of strategic consumers. We examine the effect of advance selling strategies on consumers' purchasing behavior, the firms' equilibrium prices and capacities and their expected payoffs.

4 - Dynamic Pricing When Consumers Regret

Javad Nasiry, Ph. D. Student, INSEAD, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Javad.NASIRY@insead.edu, Ioana Popescu

We model the dynamic pricing problem of a monopolistic firm in a two period market where consumers are prone to regret. Sophisticated consumers anticipate regret and make decisions to maximize their surplus, net of regret. We characterize consumer behavior in the presence of regret in this dynamic setting, and investigate the firm's optimal selling and pricing structure under various scenarios.

■ TD32

H-Room 504, Fifth Level

Option Pricing and Applications

Contributed Session

Chair: Hongyan Chen, Missouri University of Science and Technology, 1208 N Oak Street, Apt. 1, Rolla, MO, 65401, United States of America, wdy525@gmail.com

1 - Pricing of Multiple Exercisable Real Options

Yu Meng, PhD Candidate, Missouri University of Science & Technology, 223 Engineering Management, 600 W. 14th St., Rolla, MO, 65409-0370, United States of America, ym3g7@mst.edu, Zhen Liu

We propose a general framework for valuing multiple exercisable real options, where an expansion option must be exercised before an abandonment option. Using the Binomial Tree Pricing Model, we show how to determine the value of the options and account for the interaction among them.

2 - Monte Carlo Option Pricing When the Underlying Security Price Follows a Jump-diffusion Process

Samim Ghamami, University of Southern California, 3215 Overland Ave, Apt # 7176, Los Angels, 90034, Los Angeles, CA, 90034, United States of America, ghamami@usc.edu, Sheldon M. Ross

We introduce efficient simulation procedures for pricing barrier options when the underlying security price follows a geometric Brownian motion with jumps. Our proposed Monte Carlo estimators of both knock-out and knock-in barrier options lead to significant variance reduction compared to the raw simulation estimator introduced by Metwally and Atiya (2002).

3 - Decision-making Tool for Project Investments Based on Real Options (Case: Wind Power Generation)

Jose I. Munoz, Dr., University of Castilla - La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, 13071, Spain, joseignacio.munoz@uclm.es

1st: The volatilities of market prices and wind regimes are obtained from GBM-MR and Weibull models. From these and other values the NPV curve of the investment is calculated, as well as its average volatility. 2nd: A real options valuation method is applied. The volatility of the NPV curve is inserted into a trinomial investment option valuation tree. In this way, it's possible to calculate the probabilities of investing right now, deferring the investment, or not investing at all.

4 - Portfolio Selection Under Discrete Choice Constraints

Stephen J. Stoyan, University of Southern California (USC), Daniel J Epstein Department of Industrial and Systems Engineering (ISE), 3715 McClintock Avenue, Los Angeles, CA, United States of America, stoyan@usc.edu, Roy Kwon

We present portfolio selection models subject to discrete choice constraints. Designing portfolios that consider current managing constraints is challenging due to the need to hold many securities and include a rebalancing strategy. We consider two portfolio models that incorporate a comprehensive set of real world constraints, of which both focus on the number of securities to hold. Uncertainty is included in the design using a two-stage stochastic mixed-integer program. The resulting problems use two different model specific algorithms to generate solutions in reasonable time.

5 - An Option for Improved Public-private Partnership in BOT Projects

Hongyan Chen, Missouri University of Science and Technology, 1208 N Oak Street, Apt. 1, Rolla, MO, 65401, United States of America, wdy525@gmail.com, Ruwen Qin

We design an option for improved public-private partnership. In a Build-Operate-Transfer (BOT) project the right that the public entity offers to the private entity to continue operating the project after the concession term expires is modeled as an European option. Results show a BOT contract with such option motivates the private entity to augment the capital investment for greater benefits, and meanwhile, helps the public entity reduce its risk under unfavorable future conditions.

■ TD33

H-Room 505, Fifth Floor

Supply Chain Management

Cluster: Economic Models in Operations Management
Invited Session

Chair: Fernando Bernstein, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States of America, fernando@duke.edu

1 - Competitive Pricing with Strategic Customers

Dan Zhang, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, dan.zhang@mcgill.ca, Qian Liu

We consider competitive pricing between two sellers when a portion of the customers is strategic. We first study the perfect information competition. We then consider the case where firms may have uncertainty around strategic customer behavior. We discuss the implications of our results.

2 - Implications of a Site-to-Store Channel for Supply Chain Performance

Shuya Yin, Assistant Professor, University of California-Irvine, Paul Merage School of Business, Irvine, CA, 92697, syin@exchange.uci.edu, Rick So, James Cao

As internet retailing has become increasingly prevalent, firms have continued to innovate by adopting multi-channel strategies. One of these innovations is the introduction of a distribution channel, commonly known as site-to-store, where consumers can purchase online and pick up in-store. In this project, our focus is on understanding the effects of the site-to-store channel on the retailer's pricing strategy, profitability, and demand realization.

3 - Advance Purchase Contracts in a Multi-location System with Transshipment

Pengfei Guo, Assistant Professor, Hong Kong Polytechnic University, Hung Hum, Kowloong, Hong Kong, Hong Kong - PRC, lgtpguo@polyu.edu.hk, Yulan Wang, Fernando Bernstein

Under an advanced purchase contract, a retailer is offered two ordering opportunities: an early order, at a discounted price, before the supplier starts production, and a late order, at regular price, after observing demand. In this project, we explore the use of an advanced purchase contract by a firm that sells its products through multiple retail locations and has the ability to transship inventory between these locations.

■ TD34

H-Room 520, Fifth Floor

Joint Session OR-Societal Impact/TSL: Logistics and Response in Large-Scale Disaster

Cluster: OR/MS with Societal/ Humanitarian Impact & Transportation Science and Logistics
Invited Session

Chair: Lisa (Lichun) Chen, University of Maryland, 1173 Glenn Martin Hall, Department of Civil and Environmental Eng, College Park, MD, 20742, United States of America, lcchen@umd.edu

1 - Simulating Catastrophes for Disaster Management
Pamela McCauley Bush, Associate Professor, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL 32816, United States of America, mcbush@mail.ucf.edu, Steven A. Diaz, Maria Teressa Bull, Yanshen Zhu, Asli Soyler

This paper presents a dynamic simulation tool for managing the complex disaster systems which partitions behavioral and functional components into discrete time periods by creating a platform that integrates information from different models. Predicted impact of the disasters on the population is used for supporting USACE with their mitigation plans and optimization in agency distribution and evacuation plans.

2 - Pre-positioning Planning for Emergency Response with a Reliability Constraint
Mark Turnquist, Professor, Cornell University, 309 Hollister Hall, Ithaca, NY, 14853, United States of America, mat14@cornell.edu, Carmen Rawls

We describe a stochastic optimization model that determines locations and capacities of emergency distribution centers and allocates inventories of multiple relief commodities. In addition to costs and penalties for not meeting demands, the model includes a reliability constraint to ensure that in at least R% of considered scenarios, the average distance each commodity type has to be moved is less than a specified limit. A case study using hurricane threats is used to illustrate the model.

3 - Sheltering Network Design and Management Responding to Natural Disasters
Mingzhou Jin, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, mjin@ise.msstate.edu, Lingfeng Li

The paper considers sheltering network design and operations for disaster responses with a two-stage stochastic program. The first phase decides locations and capacities of permanent shelters. The second phase allocates evacuees and resources to shelters. The Bender's decomposition is applied. Each sub-problem is a linear program and could be modeled as the network flow problem with general equal flows. The numerical experiments demonstrate that the decomposition converge well.

4 - Solving the Urban Search and Rescue Team Deployment Problem
Elise Miller-Hooks, Associate Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, elisemh@umd.edu, Lisa (Lichun) Chen

The problem of optimally deploying multiple homogeneous USAR teams to disaster sites within a disaster region, and ordering the site visits, such that the expected number of saved lives is maximized over a given horizon is addressed. The number of people in need of assistance and the time required to serve them are random. The problem is formulated and techniques are presented for their solution.

■ TD35

H-Sapphire A, Fourth Floor

Stochastic Programming and Cost Effectiveness Applications in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Osman Ozaltin, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, oyo1@pitt.edu

1 - Designing Primary Care Physician Panels
Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu, Brian Denton, James Stahl

We present a stochastic programming framework to help determine the optimal size and composition of physician panels in primary care. Our objectives are two measures important for any practice: timely access, which provides patients with appointments whenever they need care; and continuity of care, which tries to have patients see their own assigned physician and develop a long-term patient-physician relationship. We analyze results using data from the primary care practice at the Mayo Clinic.

2 - Optimizing Annual Flu Shot Design and Timing
Osman Ozaltin, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, oyo1@pitt.edu

Seasonal flu epidemics, which are caused by antigenic drifts and high rate of transmission, may require annual updates in the flu shot composition. The World Health Organization recommends which flu strains to include in the annual vaccine based on surveillance and epidemiological analysis. We formulate a multistage stochastic mixed-integer program, which quantifies the trade-off between the composition and timing decisions. We carefully calibrate our model and derive fast solution techniques.

3 - Cost-effectiveness of Bariatric Surgery as a Treatment for Type 2 Diabetes
Cindie Wu, Student, Stanford University, 218 Ayrshire Farm Lane, Apt. 304, Stanford, CA, 84305, United States of America, cindiewu@stanford.edu

The growing prevalence of diabetes is a concern in the US, but morbidly obese patients who have bariatric surgery experience remarkable rates of diabetes remittance aside from weight loss. Our Markov model determines the cost-effectiveness of bariatric surgery, relative to non-operative therapy, as treatment for Type 2 diabetes in moderately overweight individuals, who are not currently eligible for bariatric surgery. Expanding to include this cohort may improve diabetes management standards.

■ TD36

H-Sapphire B, Fourth Floor

Health Care Access

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Organizing Outpatient Clinics: The Viability of Walk-in Based Policies
Nikky Kortbeek, PhD Candidate, University of Twente, Drienerlolaan 5, Enschede, 7500AE, Netherlands, N.Kortbeek@ewi.utwente.nl, Maartje Zonderland, Richard Boucherie, Nelly Litvak

Outpatient clinics and diagnostic testing facilities traditionally provide patients with individual appointments to balance workload. Disadvantages however, include patients needing to revisit the hospital, an involved planning process and potentially long access times. This study explores the viability of various walk-in based policies. We present a stochastic method that finds the mixed strategy that optimally balances the benefits and drawbacks of the pure appointment and walk-in policies.

2 - Improving Patient Flow at the Foothills Hospital Orthopedic Clinic
Tom Rohleder, Senior Associate Consultant, Mayo Clinic, Div. of Health Care Policy and Research, 200 First Street SW, Rochester, MN, 55905, United States of America, rohleder@mayo.edu, Paul Duffy, Peter Lewkonia

We report on a process improvement project aimed at reducing patient congestion and waiting time in a cast clinic. This case study shows how simulation modeling was used to reduce patient waiting times without significantly increasing the clinic's total hourly length. After implementing an improved scheduling approach in the clinic, the average waiting time was reduced by about 30 minutes per patient with only a small increase in the overall clinic length.

3 - Home Health Care Services: Models and Algorithms
Stefan Nickel, Insitute for Operations Research, Universitaet Karlsruhe (TH), Geb. 11.40, Karlsruhe, Germany, stefan.nickel@kit.edu, Michael Schroeder, Joerg Steeg

Home health care (HHC) services provide nursing assistance to the elderly with the advantage of allowing them to continue a life at their homes. Usually a HHC service has a fleet of vehicles that are used by nurses with different qualification levels to get to the patients, where they have to perform a specified job. The HHC problem can be stated as follows: assign a nurse to each patient such that several conflicting objective functions are minimized, while a number of constraints are met.

■ TD37

H-Sapphire C, Fourth Floor

Empirical Research on Supply Chain Management

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu

1 - Impact of Performance Based Contracting on Product Reliability: An Empirical Analysis
Jose A. Guajardo, Ph.D. student, The Wharton School, University of Pennsylvania, 3730 Walnut st. JMHH suite 500, Philadelphia, United States of America, josegu@wharton.upenn.edu, Morris A. Cohen, Sang-Hyun Kim, Serguei Netessine

In this paper, we empirically investigate the impact of contract incentives on product reliability. Using a proprietary dataset provided by a major manufacturer of aircraft subsystems, we estimate a two-stage model that explicitly takes into account the inherent endogeneity in contract choice by the customer. The analysis provides evidence for the positive and significant effect of performance incentives on product reliability.

2 - Global Sourcing: The Role of Mismatch Costs
Karan Girotra, Assistant Professor, INSEAD, Boulevard De Constance, Fontainebleau, France, karan.girotra@insead.edu, Taylor Randall, Marcelo Olivares

We combine multiple data sources covering global trade flows, sales and inventory trends to identify patterns in global sourcing. We then attempt to understand the drivers of these trends and study their implications on operational performance.

3 - On the Link Between Joint Inventory/Sales Dynamics and Financial Performance
Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Sergey Rumyantsev

Using financial accounting panel data from the COMPUSTAT database for a universe of all inventory-carrying companies in the period from 1994 to 2003, we develop a statistical methodology that links managerial decisions about inventory with accounting returns.

4 - Estimating the Effect of Inventory on Demand
Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, 10027, United States of America, molivares@columbia.edu, Gerard Cachon

We develop an estimation strategy to measure the effect of inventory on sales. We seek two identify to separate mechanisms: (1) a censored demand effect, where changes in inventory affect lost sales; (2) a "billboard" effect where changes in inventory affects demand directly, for example, by increasing customer awareness of the product. We use our estimation methodology with data from DVDs sold at 300 stores of a major big-box retailer.

■ TD38

H-Sapphire D, Fourth Floor

Data Driven Algorithms for Stochastic Inventory Control

Cluster: Inventory Management
Invited Session

Chair: Retsef Levi, Assistant Professor, Sloan, School of Management, MIT, 50 Memorial Drive Building E53-389, Cambrideg, MA, 02142, United States of America, retsef@MIT.EDU

1 - Managing Inventory in the Presence of Finite Historical Demand Data
Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu, Alp Akcay, Sridhar Tayur

We consider the practical situation where the demand distribution and the values of its parameters are unknown and only a finite amount of historical demand data is available. We quantify the inaccuracy in the inventory policy estimation and set inventory targets in the presence of this finite data. Our procedures can be easily implemented in practical settings.

2 - The Repeated Newsvendor Problem with Expert Advice
Tim Huh, Columbia University, 500 West 120th St, New York, United States of America, th2113@columbia.edu, Thiam Lee

We consider the finite-horizon repeated newsvendor problem with changing and unknown demand in the presence of two experts who provide stocking-level recommendations. As a proxy to handle the consequent complexities, the expert recommendations and demand outcomes are chosen by an adversary. Our goal is to minimize the regret from not having chosen the a posteriori better expert to follow from the onset. We give an optimal algorithm to solve this problem and analyze its asymptotic performance.

3 - Data-Driven Approaches for Newsvendor Models
Joline Uichanco, PhD candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, uichanco@MIT.EDU, Retsef Levi, Georgia Perakis

We consider the single-period newsvendor problem. Given the demand distribution, the optimal order quantity is known. Usually, only past demand data is available. A heuristic approach uses the empirical distribution as a proxy. We show theoretical bounds on the samples needed for the heuristic to be epsilon-close to the optimal cost. We also provide a tighter bound for distributions with log-concave densities. This bound is close to the number of samples observed in simulation experiments.

■ TD39

H-Sapphire E, Fourth Floor

Strategic and Tactical Procurement in Supply Chain

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Xinxin Hu, Assistant Professor, Indiana University, 1309 East 10th Street, Bloomington, IN, 47405, United States of America, hux@indiana.edu

Co-Chair: Shanshan Hu, Assistant Professor, Indiana University at Bloomington, hush@indiana.edu

1 - Group Buying Mechanisms under Quantity Discounts
Rachel Chen, Assistant Professor, University of California at Davis, rachen@ucdavis.edu, Cuihong Li, Rachel Zhang

When a seller offers quantity discounts, interested buyers may either self-organize or rely on a third party to aggregate their purchasing quantities to obtain lower prices, referred to as group buying. A group buying mechanism determines the amount each buyer will purchase and the price each buyer will pay. In this paper, we study buyers' purchasing behavior and surplus given a seller's quantity discount schedule under both the uniform and non-uniform price group buying mechanisms.

2 - Integrated Optimization of Procurement, Processing and Trade of Commodities
Sripad Devalkar, PhD student, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, devalkar@bus.umich.edu, Ravi Anupindi, Amitabh Sinha

Motivated by the operations of a prominent commodity processing firm, we consider the integrated optimization problem of procurement, processing and trade of commodities over a network in a multiperiod setting. For a risk-neutral decision maker, we show that the single-node version of this problem can be solved optimally and develop tractable heuristics for the multi-node network problem. Additionally, we also discuss some results for the risk-averse case.

3 - Unit-Price Procurement Auctions with Asymmetric Information
Shanshan Hu, Assistant Professor, Indiana University at Bloomington, hush@indiana.edu, Qing Ye, Roman Kapuscinski, Uday Rajan

We study the impact of asymmetric information in procurement auctions and compare discriminatory and uniform formats. When suppliers' costs are private information, the equilibrium is jointly controlled by a supplier relative size and uncertainty about costs. When capacities are private information, discriminatory auctions always have monotone equilibrium, where supplier's bids decrease in capacity, while revenues increase. For uniform auctions, monotone equilibrium does not necessarily exist.

■ TD40

H-Sapphire H, Fourth Floor

Pricing Problems in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Hyun-soo Ahn, University of Michigan, Stephen M Ross School of Business, 701 Tappan Street #4428, Ann Arbor, MI, 48109, United States of America, hsahn@umich.edu

Co-Chair: Goker Aydin, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, ayding@umich.edu

1 - Supply Chain Efficiency and Contracting in the Presence of Gray Market
Mehmet Altug, Columbia University, 3022 Broadway Uris Hall, New York, NY, 10027, United States of America, maltug10@gsb.columbia.edu, Garrett van Ryzin

We consider a supply chain with one manufacturer and several authorized retailers that face uncertain demand and a potential gray market. While the gray market can be seen as an opportunity to sell any excess inventory, it also is a threat for authorized retailer's demand. We characterize the equilibrium market-clearing gray market price and retailers' quantity decision. We compare decentralized and centralized system and show that wholesale pricing contract itself is "almost" coordinating.

2 - Dynamic Pricing of Limited Inventories When Customers Negotiate
Chia-Wei Kuo, Assistant Professor, National Taiwan University, 85 Sec 4, Roosevelt RD., Taipei, 106, Taiwan - ROC, cwkuo@ntu.edu.tw, Goker Aydin, Hyun-soo Ahn

We consider a retailer that faces two types of consumers price-takers and bargainers. The retailer's posted price serves as the take-it-or-leave-it price for price-takers, and it is the price from which bargainers negotiate down. We characterize the optimal posted price and the resulting negotiation outcome as a function of inventory and time. If negotiation is costly, the retailer prefers to implement it when the inventory level is high and the remaining selling season is short.

3 - Dynamic Pricing and Capacity Flexibility
Oben Ceryan, PhD candidate, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, oceryan@umich.edu, Ozge Sahin, Izak Duenyas

We study a joint mechanism of dynamic pricing and capacity flexibility to mitigate demand and supply mismatches. We consider a firm producing two products with correlated demands utilizing product dedicated and flexible resources and characterize the structure of the optimal production and pricing decisions. We investigate how the availability of a flexible resource influences the firm's pricing strategy and compare the economic benefits of a joint strategy over applying each tool separately.

4 - Joint Pricing and Production Decisions in an Assemble-to-order System
Sechan Oh, Stanford University, 380 Panama Way, Stanford, United States of America, scoh@stanford.edu, Karthik Sourirajan, Markus Ettl

We study a manufacturer who maximizes his profit over a finite horizon by making pricing, inventory replenishment, and component allocation decisions in an ATO system. We propose an implementable heuristic policy, which decouples the pricing, production decisions. We show that this policy performs well by simulating the profit under various environments. For the simulation test, we develop a simple, yet effective control variate, which reduces the variance of the estimator.

■ TD41

H-Sapphire L, Fourth Floor

Energy, Environment, and Sustainability

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Valerie Thomas, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, valerie.thomas@isye.gatech.edu

1 - Modeling Rail Impacts of Ethanol Shipping
Matt Kocoloski, Research Assistant, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, mkocolos@andrew.cmu.edu, W. Michael Griffin, H. Scott Matthews

Recent legislation requires domestic ethanol production to reach 36 billion gallons per year by 2022. Ethanol cannot be shipped through petroleum pipelines, so domestic ethanol shipping relies heavily on rail transportation. Here, we formulate rail freight shipments as a traffic assignment problem to estimate congestion resulting from ethanol shipments. We examine the impacts of distribution policies such as regional ethanol distribution to reduce rail congestion.

2 - Analysis of Cost, Energy and Environment in Packaging Solutions in International Supply Chain
Chen Zhou, Associate Professor, Georgia Institute of Technology, chen.zhou@isye.gatech.edu

The low cost in manufacturing propelled many firms to source their products off-shore. The off-shore manufacturing often reduces the cost but significantly prolongs the supply chain, and possibly leads to bigger environmental foot print. A case study was conducted to analyze the cost, the energy and eco-indicator of different packaging solutions for an automobile component. We extended the value stream map to analyze cost as well as energy consumption and the change in eco-indicators.

3 - Characteristics of Dynamic Decision Making in a Reverse Production System with Retailer Collection
Chanjoo Lee, PhD Candidate, Georgia Tech, H. Milton Stewart School of Industrial a, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, chanjoo.lee@gatech.edu, Matthew Realff, Jane Ammons

We present a continuous time differential game model that integrates pricing, production, and inventory decisions in a reverse production system with retailer collection. The OEM, the leader, is assumed to be motivated by potential economic values of returns and the retailer, the follower, by the incentives from the OEM. We identify the conditions under which both firms can increase profits and demands. The results show that firms can benefit from extensive product recovery activities.

4 - Computational Sustainability: An Interdisciplinary Approach
David Shmoys, Professor, Cornell University, 231 Rhodes Hall, Hoy Road, Ithaca, NY, 14853, United States of America, shmoys@cs.cornell.edu, Carla P. Gomes

Computational sustainability is the study of advanced computational models & methods for balancing environmental, economic, and societal needs for sustainable development. A recent NSF Expeditions grant brings together researchers in constraint optimization, dynamical systems, & machine learning, working with biologists and environmental scientists, to address these problems of unique scale, impact, complexity, & richness. Recent work on a metapopulation model for RCW will highlight these goals.

■ TD42

H-Sapphire P, Fourth Floor

Supply Chain Coordination I

Contributed Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu

1 - Coordinating a Channel in Presence of a Power Retailer
Xuemei Su, Assistant Professor, California State University Long Beach, 1250 Bellflower Blvd, Long Beach, CA, 90815, United States of America, xsu@csulb.edu, Samar Mukhopadhyay

We investigate a distribution system where a manufacturer sells through a number of retailers one of whom is dominant. The dominant retailer is the price leader and provides demand-stimulating services. We study two contract types namely, quantity discount and revenue sharing to examine which coordinates the channel and prevents the dominant retailer' reselling activities.

2 - Vertical Integration in Competing Supply Chains under Additive Stochastic Demand
Chongqi Wu, Assistant Professor, California State University, East Bay, 25800 Carlos Bee Boulevard, Hayward, CA, 94542, United States of America, chongqi.wu@csueastbay.edu, Hongwei Du, Xinjian Lu

This article studies integration/decentralization in competing supply chains under demand uncertainty. Two firms each produce a substitutable product and sell it through a decentralized or an integrated store, modeled as price-setting newsboy. We show that demand uncertainty may favor either integration or decentralization, depending on how demand uncertainty is characterized. Another important finding is that increase in horizontal competition does not always hurt manufacturers or retailers.

3 - A Dynamic Game of Supply Chain Coordination and Horizontal Competition
Pietro De Giovanni, PhD Candidate, Essec Business School, Avenue du Prefecture, Cergy Pontoise Paris, France, pietro.degiovanni@esse.fr, Fouad El Ouardighi

In this paper we consider two supply chains, each consisting of one manufacturer and one retailer. The supply chains compete for market demand both on price and advertising goodwill. The paper analyzes the players' optimal policies on inventory management, retail price, and advertising effort over time. We compare the possible outcomes under a wholesale price contract and a revenue sharing contract.

4 - Integrating Advance Demand Information in Supply Chain Contracts
Ananth Krishnamurthy, University of Wisconsin-Madison, ME 3258, Dept of ISyE, Madison, WI, 53706, United States of America, ananth@engr.wisc.edu, Deng Ge

Advance demand information obtained from market survey mechanisms could be extremely valuable in optimizing production and inventory stocking decisions in a supply chain. This research investigates how this information can be integrated into typical contracts observed in supply chains and determines optimal decisions in a multi-period setting.

■ TD43

H-Room 400, Fourth Floor

Managing Commodity Risk in Supply Chain

Cluster: Supply Chain Models
Invited Session

Chair: Lingxiu Dong, Washington University in St. Louis, Olin Business School, 1 Brookings Drive, St. Louis, MO, 63130-4899, United States of America, dong@wustl.edu

Co-Chair: Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu

1 - Optimal Managerial Compensation and Financial Hedging in Commodity Procurement

Masha Shunko, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, mshunko@andrew.cmu.edu, Nicola Secomandi, Laurens Debo, Lin Nan

Consider a firm that uses a traded commodity as input to its production process and employs a risk-averse procurement manager. We study the interaction between the firm's financial hedging policy and the manager's procurement policy, the manager's optimal compensation structure, and the sensitivity of this structure to relevant parameters. We find that the optimal bonus for the manager is nonmonotone in various parameters of interest and only medium size firms benefit from financial hedging.

2 - Capacity Management for Agricultural Commodities

Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

This paper analyzes the capacity investment portfolio of a processor that uses a single input to produce multiple products in fixed proportions. The input and each output production require dedicated capacities. The main motivation comes from agribusiness where the input and some of the outputs are commodities and are traded on the spot markets. We investigate the effect of spot price variability, correlation among different end-products on the optimal capacity investment portfolio.

3 - Effect of Term Structure of Futures Price on Spot Procurement Policies

Ankur Goel, Case Western Reserve University, ankur.goel2@case.edu, Genaro Gutierrez

In this research, we explore the effect of term structure information of futures prices on the procurement policies from the spot market. We compare one-factor stochastic price model with a two-factor model to quantify the benefits of higher term structure model on operating policies. We conclude that for gasoline the two factor price model leads to substantial inventory cost savings. In addition, the frequent calibration of the price process has marginal benefit.

4 - Value of Processing Flexibility in Uncertain Input and Output Markets

Xiaole Wu, Ph.D. Candidate, Olin Business School, One Brookings Drive, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Lingxiu Dong, Panos Kouvelis

We consider a processing plant that takes in commodity inputs at various quality levels and processes them into intermediates that will be blended into various outputs. We focus on a specific type of processing flexibility that is used in the oil refinery industry, that is, converting low quality intermediates to high quality ones. We examine the value of such operational flexibility in an environment where input and output prices are volatile.

■ TD44

H-Room 402, Fourth Floor

Models of Service Management

Sponsor: Service Science
Sponsored Session

Chair: Ralph Badinelli, Virginia Tech, 1007 Pamplin Hall, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

1 - Dynamic Planning of Service Processes

Ralph Badinelli, Virginia Tech, 1007 Pamplin Hall, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

In this paper we extend previous model development to the case of multi-stage resource planning and process scheduling for services. We assume that the product-service system (PSS) requires the coordinated and adaptive participation of the service provider and the service recipient through a sequence of state-dependent processes (taktchronicity). Policies for resource commitment and dispatching are suggested and evaluated.

2 - Learning and Relearning Effects with Service Designs: An Empirical Analysis of Top Golf Courses

Gregory Heim, Assistant Professor, Texas A&M University, INFO Department Mays Business School, 320 Wehner Building 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu, Michael Ketzenberg

This paper examines learning and relearning effects in service environments where the service facility innovation and design activity is typically outsourced to external design firms. We explore whether the quality of service experiences changes over time in directions consistent with a learning curve effect. The findings illustrate how service outcomes can be negatively affected by service redesigns, and showing how learning effects can overcome such challenges over time.

3 - Impact of Productivity on Staffing Flexibility

Adelina Gnanlet, Assistant Professor, California State University at Fullerton, Department of Management, California State University at Fullerton, Fullerton, CA, United States of America, agnanlet@fullerton.edu, Wendell Gilland

We derive a closed form expression for the optimal amount of cross-training for nurses between two hospital units. We use a two-stage stochastic programming with recourse model that minimizes cost for general demand distributions. We analyze the impact of cross-training cost, demand variation and productivity on optimal nurse flexibility.

■ TD45

H-Room 410, Fouth Floor

Organization Theory I

Contributed Session

Chair: Masato Suzuki, Doctoral Student, Meiji University, 2028 Karuizawa, Kamagaya-shi, Chiba-ken, 273-0131, Japan, msuzuki0107@gmail.com

1 - Psychological Costs of Seeking Social Support: Scale Development and Factor Analysis

Vivien Lim, Associate Professor, NUS, Department of Management and Organizatio, Singapore, Singapore, bizlimv@nus.edu.sg, Xiuxi Zhao, Thompson Teo

When seeking social support, one may feel bad about self (intrapersonal cost) or worry about others judgment (interpersonal cost). Two studies were conducted to develop the scale of support seeking cost.Factor analysis reveals four dimensions under each type of cost:"negative thoughts","doubt of self worth","doubt of competence"and"doubt of self-reliance".The analysis of gender differences also reveals that men and women differ on two of the eight dimensions.

2 - Seeking Support Face-to-Face or Via Email? The Role of Support Seeking Cost

Xiuxi Zhao, Student, NUS, NUS Business School, Department of M&O, 1 Busines Link, BIZ2 Building, Level 4, Singapore, 117592, Singapore, zhao.xiuxi@nus.edu.sg, Thompson Teo, Vivien Lim

When seeking social support, one may feel bad about self (intrapersonal cost) or worry about others judgment (interpersonal cost). Items were developed to measure two types of cost. Survey data reveals that only the latter type of cost is significantly related to seekers preference of indirect support seeking (email) to direct f2f support seeking. Women have higher preference of seeking support through email over face-to-face.

3 - Condoning Violence Among College Students: The Influence of Musical Preference

Zara Boukary, MBA Student, Savannah State University, College of Business Administration, 3219 College St, Savannah, GA, 31404, United States of America, zboukary@student.savannahstate.edu, Dominique Jackson, Ulysses Brown

Using college students, this research examines the relationship between musical preference and condoning violence against men and women. Recently, celebrities have highlighted the social problem of domestic violence in American communities. Findings indicate that subjects who preferred rap music were more likely to condone violence against men and women.

4 - CEO Succession and Organizational Alignment: A Middle Management Perspective

Masato Suzuki, Doctoral Student, Meiji University, 2028 Karuizawa, Kamagaya-shi, Chiba-ken, 273-0131, Japan, msuzuki0107@gmail.com

This paper articulates the role of middle managers in strategic change that is triggered by a successor CEO. I develop an initial conceptualization of how middle managers intervene in a CEO succession-strategic change-outcomes process. The paper suggests a hidden underlining mechanism in strategic change

by shedding light on middle management perspectives as well as proposes that the research of the organizational alignment is an important research direction in CEO succession studies.

■ TD46

H-Room 411, Fourth Floor

Modularity in Services: Efficiency, Flexibility, and Innovativeness

Sponsor: Technology Management
Sponsored Session

Chair: Saara Pekkarinen, Project Leader, University of Oulu, P.O.Box 4600, Oulu, 90014, Finland, saara.pekkarinen@oulu.fi

1 - Modular Service Innovation: Managing Customer Knowledge in Creating Business Services

Minna Rollins, University of West Georgia, Richards College of Business, 1600 Maple St., Carrolton, GA, Carrolton, United States of America, mrollins@westga.edu, Saara Pekkarinen

This paper discusses the role and importance of customer knowledge in creating modular business services. Authors conceptualize how service firms can utilize their customer knowledge and manage customer interface in creating modular business services. This research integrates literature on modularity and service innovation from services marketing, service operation management, and knowledge management. In addition, authors discuss managerial implications for service firms.

2 - Key Modularity Dimensions of Service Innovations

Saara Pekkarinen, Project Leader, University of Oulu, P.O.Box 4600, Oulu, 90014, Finland, saara.pekkarinen@oulu.fi, Jouni Juntunen, Jari Juga

Paper explores modularity in creating logistic services and the patterns of organizational adjustments that might be required. Modularity dimensions 1) collaboration and coordination of functions, 2) integration and coordination of resources, and 3) interaction and communication are examined. This research builds on economics and management literature on modularity. Field data simulation and interviews result in theoretical and managerial implications.

3 - The Effect of Standardization and Agility on Logistics Costs

Vesa Autere, National Defense University, Department of Leadership and Military Pedagogy, Santahamina, Helsinki, Finland, vesa.autere@mil.fi, Jouni Juntunen, Mari Juntunen

This paper examines how standardization and agility affect the logistics costs of logistics service purchasers. A conceptual model is developed and tested with structural equation modeling (SEM) using empirical data from the Finnish Defense Forces, public sector and industrial companies. The results show that standardization promotes agility and agility advances cost reductions. Thus, standardization and agility are essential elements when the organization structure is modular.

4 - Soft and Hard Commitments: Two Supplement Methods to External Economies

Jouni Juntunen, University of Oulu, Faculty of Economics and Business Administration, P.O.Box 4600, Oulu, Finland, jouni.t.juntunen@oulu.fi, Mari Juntunen

The purpose is to study the relationship of soft (relationships and corporate brand image) and hard (relationship specific investments) commitments with external economies. A conceptual model is tested with SEM using empirical data from Finnish industrial companies. Response rate of survey was 22.5 % (N=235). The results show that corporate brand image and relationship-specific investments are a supplement component of external economies in modular organization structure.

■ TD47

H-Room 412, Fourth Floor

Globalization of Services

Cluster: Global Sourcing of Services
Invited Session

Chair: Sunil Mithas, Assistant Professor, University of Maryland, 4324 VMH U of Maryland, College Park, United States of America, smithas@rhsmith.umd.edu

1 - Human Resource Management Issues in the Global Delivery of Services

Jonathan Whitaker, Assistant Professor, University of Richmond, Robins School of Business, 1 Gateway Road, Richmond, VA, 23173, United States of America, jwhitaker@richmond.edu, Sunil Mithas

Rapid growth in the global production and delivery of services, including business process outsourcing (BPO), has enabled a large number of workers in emerging economies to pursue white-collar careers for the first time. This research identifies key HR issues for BPO employees in emerging economies, and conducts an empirical examination of these issues using survey data on Indian BPO employees.

2 - Quality Dimensions in IT Outsourcing Provision: An Empirical Analysis of Service Components

Ramanath Subramanyam, Assistant Professor, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth St., Champaign, IL, 61820, United States of America, rsubrama@illinois.edu, M.S. Krishnan, Wooje Cho

In this paper, we investigate drivers of customer satisfaction in IT outsourcing services. Using data collected on 185 outsourcing agreements from a leading global vendor of IT services, we analyze the effect of several quality drivers across different levels of overall satisfaction. We use the Quality-Function-Deployment framework to generate service supply implications for IT service providers.

3 - Internationalization Strategies of IT Service Vendors From Emerging Economies: The Case of China

Ning Su, Stern School of Business, New York University, 44 West 4th street, Rm. 8-185, New York, NY, 10012, United States of America, nsu@stern.nyu.edu, Natalia Levina

As China rapidly emerges as the new frontier of global IT outsourcing, the country's IT service industry undergoes a profound change: many leading vendors are strategically shifting their client bases from Japan to the U.S. and Europe. Through qualitative case studies of eleven major IT service firms in China, this paper elaborates the process by which China-based vendors transform their capabilities developed in domestic and Japanese markets to internationalize into the Western market.

4 - Does Training Improve Performance of Offshore IT Workers?

Nishtha Langer, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, nishtha_langer@isb.edu, Ravi Bapna, Amit Mehra, Ram Gopal, Alok Gupta

Firms in the IT services industry invest in employee training for productivity and competitive gains, but the link between training and employee performance is missing. We show this by using detailed archival training and employee level data from a leading IT services vendor. Using a fixed effects model, we find that even after controlling for employee experience, training improves performance, and that training and experience are substitutes; training at higher experience may be detrimental.

■ TD48

H-Sapphire Green Room, Fourth

Decision Making and Process Improvement in Complex Service Organizations

Cluster: Service Operations Management
Invited Session

Chair: Anita Tucker, Assistant Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu

1 - Diagnosing in Action: Virtuous and Vicious Cycles

Bradley Morrison, Brandeis International Business School, Waltham, MA, United States of America, bmorriso@brandeis.edu, Jenny Rudolph, John Carroll

Drawing on observation of doctors handling a medical emergency, we develop a system dynamics model of diagnostic problem solving that links interpretation and choice. Three insights emerge: (1) diagnostic problem solving includes acting, interpreting, and cultivating diagnoses; (2) dynamic interaction among these processes generates adaptive and failed modes problem solving; and (3) reinforcing feedback processes, usually considered dysfunctional, are essential for adaptive problem solving.

2 - Diversity in Experience and Team Familiarity: Evidence From Software Development

Bradley Staats, Assistant Professor, University of North Carolina, Kenan Flagler Business School, McColl Building, Chapel Hill, NC, United States of America, bstaats@gmail.com, Robert Huckman

Fluid teams with different sets of prior experience execute critical projects in organizations. Though building teams with diverse experience is needed, work on diversity in experience and performance fails to find a consistent effect. The issue is that diversity improves a team's functioning, but creates coordination challenges. We hypothesize that team familiarity helps teams leverage the benefits of diversity by alleviating coordination problems. We test this with software project data.

3 - Resource Allocation in Software Maintenance
Sriram Narayanan, Assistant Professor, Michigan State University, N357 Business College Complex, East Lansing, MI, 48824, United States of America, narayanan@bus.msu.edu, Sridhar Balasubramanian, Jay Swaminathan

We study allocation of engineering resources in software maintenance. We show that as software bugs stay in the system longer, the probability of successfully resolving them reduces. We use this insight to estimate engineering resources required to manage debugging effort. We explore cut off policy based on threshold time without finding a successful resolution. Our analysis shows that such policies minimally impact rate of successful resolution and reduce waiting times for incoming bugs.

4 - Do Professional Service Firms Learn From Outsourced Projects?
Ram Ganeshan, Professor, College of William and Mary, Mason School of Business, Williamsburg, VA, 23185, United States of America, ram.ganeshan@mason.wm.edu, Robert L. Hicks, Tonya Boone

Using data from a professional service firm, our research investigates if and how much, and why service firms learn from projects that are outsourced. We use learning-curve models to determine learning and forgetting rates; and provide insights into the enablers and barriers to learning with experience.

■ TD49

H-Room 300, Third Floor

Performance and Configurations of Production/Supply Systems for Multi-product Production Interruption Management

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Jeonghan Ko, University of Nebraska-Lincoln, Industrial and Management Systems Eng., Lincoln, NE, 68588, United States of America, jko2@unl.edu

Co-Chair: Hui Wang, PhD Candidate, University of Michigan, 2350 Hayward Rd, Ann Arbor, MI, 48109, United States of America, johnwang@umich.edu

1 - Multi-station Manufacturing System Design Considering Sequence Dependent Setups and Machine Types
Ehsan Nazarian, University of Nebraska-Lincoln, Industrial and Management Systems Eng., Lincoln, NE, 68588, United States of America, enazarian@unlnotes.unl.edu, Jeonghan Ko

We present optimal solutions for multi-station manufacturing system design considering manufacturing task recurrences and sequence-dependent setups. The objective is to minimize investment cost in multi-product production. Our optimization model determines the type of machines in each station considering task repetition. The model also optimizes task assignment to stations and task sequence within each station considering sequence dependent setup times and production batch sizes.

2 - Optimize Capacity, Simulate Capacity: Drain the Risk Out of Manufacturing Change
Astrid Tuin, Senior Application Engineer, LLamasoft, 206 South Fifth Avenue, Suite 400, Ann Arbor, MI, 48103, United States of America, astrid@llamasoft.com

Coca-Cola National Beverages Company wanted to reduce supply chain costs by increasing efficiency, while maintaining a flexible system that was responsive to changes in consumer needs. The main constraint on the system was limited production capacity. Optimal weekly transportation, inventory, and production plans were calculated; these were then refined using discrete event simulation. This gave CCNBC insight into service rates, inventory levels, and capacity issues at individual plants.

3 - Complexity Analysis of Assembly Supply Chains in the Presence of Product Variety
Hui Wang, PhD Candidate, University of Michigan, 2350 Hayward Rd, Ann Arbor, MI, 48109, United States of America, johnwang@umich.edu, Goker Aydin, S. Jack Hu

We propose a metric for the complexity of an assembly chain. This metric takes into account the supply chain configuration, product variety offered by the supply chain, and the demand split among the products. We investigate how this complexity metric relates to the cost of the supply chain and show that complexity and cost are equivalent under certain conditions. We illustrate how this complexity measure can be used as a proxy for cost in decision making.

4 - Capacities Expansion Problems in Manufacturing Network
Kun Huang, PhD Student, North Carolina State University, 111 Lampe Drive, 443 Danial Hall, Raleigh, NC, 27606, United States of America, khuang@ncsu.edu

The problems are based on distribution and assembly manufacturing network, which is a new kind of network introduced by Fang and Qi. Algorithm is developed to get maximum flow in manufacturing network. And after searching the most sensitive arc for output increase in the network, we provide an efficient procedure for capacities expansion plan with budget constraints.

■ TD50

H-Room 302, Third Floor

Managing Customers and Partners in Services

Sponsor: MSOM/ Service Management
Sponsored Session

Chair: Sameer Hasija, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Sameer.Hasija@insead.edu

1 - Buying From the Babbling Newsvendor: Availability Information and Cheap Talk
Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Achal Bassamboo

Provision of real-time information by a firm to its customers has become prevalent in recent years in both the service and retail sectors. In this paper, we study a retail operations model where customers are strategic in both their actions and in the way they interpret information, while the retailer is strategic in the way it provides information. This paper focuses on the ability (or the lack thereof) to credibly communicate unverifiable information.

2 - Service Outsourcing: Capacity, Quality and Correlated Costs
Fuqiang Zhang, Assistant Professor, Washington University in St. Louis, FZhang22@WUSTL.EDU, Justin Ren

This paper studies how to design service outsourcing contracts to ensure fast, quality services from an independent service provider. Both the service provider's capacity cost and quality cost are private information. We characterize the outsourcer's optimal contracts and investigate the performance of simpler, but suboptimal contracts.

3 - Contracting for Infrequent Restoration and Recovery of Mission-Critical Systems
Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu, Morris A. Cohen, Senthil Veeraraghavan, Serguei Netessine

Firms in industries such as aerospace and defense, high-tech manufacturing, and telecommunications rely on functioning mission-critical equipment. Using a model that builds upon the principal-agent framework, in this paper we show that designing a successful contract for outsourcing restoration services for such equipment creates nontrivial challenges that are unique to this environment due to the infrequent and random nature of equipment failures.

4 - Service Outsourcing Contract with Private Information on Uncertain Outcomes
Zhijian Cui, PhD Candidate, INSEAD, 40 Ave. Alfred Roll, Bois le Roi, 77590, France, Zhijian.CUI@insead.edu, Sameer Hasija

We focus on two important aspects of service outsourcing: vendor selection and relationship management under information asymmetry and uncertainty of outcomes. We study a business environment where payoffs depend on vendor effort and uncertain exogenous factors. The vendor exerts a non-observable effort and has more credible private priors on the exogenous uncertainty. We study outsourcing relationships that induce truth revelation and optimal effort by the vendor.

■ TD51

H-Room 303, Third Floor

Methods for Optimization Problems in Networks

Sponsor: Optimization/Computational Optimization and Software(Joint Cluster Computing)
Sponsored Session

Chair: Tom Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, Department of DSES, 110 Eighth Street, Troy, NY, 12180, United States of America, sharkt@rpi.edu

1 - Integrated Restoration Planning and Scheduling for Critical Interdependent Infrastructure Systems
Burak Cavdaroglu, Research Assistant, Rensselaer Polytechnic Institute, Department of DSES, 110 Eighth Street, Troy, NY, 12180, United States of America, cavdab@rpi.edu, Tom Sharkey, William Al Wallace, John Mitchell

We consider the problem of restoring services to interdependent infrastructure systems. In this problem, we need to select the infrastructure components that will be installed to restore the services, assign the selected components to work groups, and then schedule the work groups to complete their tasks. We discuss

an integrated model to determine these decisions that relies on a network flow model of the operation of the infrastructure systems. Our model is then tested on real-world data.

2 - Exact Approaches for Solving Minimum Ratio Spanning Trees with Multiple-Ratios

Oleg Prokopyev, Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, prokopyev@engr.pitt.edu, Oleksii Ursulenko, Sergiy Butenko

We consider the sum-of-ratios version of the Minimum Ratio Spanning Tree Problem. Two MIP models are derived via MTZ constraints and the single commodity flow formulation. The suggested global optimization approach is based on the same general idea as the algorithm by Skiscim and Palocsay, but specifically addresses the difficulties arising when the number of ratios exceeds two.

3 - A Column Generation Approach for Joint Vehicle Assembly-routing Problems

Ahmed Ghoniem, University of Massachusetts Amherst, 121 Presidents Dr., Amherst, MA, 01003, United States of America, aghoniem@som.umass.edu, Hanif D. Sherali

We examine logistical systems where it is desirable to appropriately ascertain the joint composition of the sequences of vehicles that are to be physically connected along with determining their delivery routes over a large network of customers. We present a novel model and a column generation approach for this challenging class of joint vehicle assembly-routing problems. Computational experience is provided using realistic data from a case-study involving a major truck manufacturing company.

■ TD52

H-Room 304, Third Floor

Marketing and Operations Strategies in the Retail Industry

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Jing Zhou, Assistant Professor, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu

1 - On the Effect of Advertising Initiatives to Promote Healthy Food

Wenqing Zhang, PhD Candidate, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, wenqing.zhang@mail.mcgill.ca, Dan Zhang, Shanling Li

In response to increasing pressure to promote healthy eating, food companies have been adopting strategic initiatives that limit advertising expenses on traditional food products. This paper studies the effect of such initiatives on firm profit and consumer welfare in a joint advertising-pricing model that explicitly considers consumer food choice.

2 - The Effects of Gift Card Sales on the Optimal Order and Discount of Seasonal Products

Jing Zhou, Assistant Professor, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu, Moutaz Khouja, Jingming Pan

Gift cards have gained popularity during the holiday season. We study the retailer's inventory-pricing decisions of seasonal products in two periods. In the first period, the retailer determines the order quantity in dollars and consumers decide to buy either products or gift cards. In the second period, the retailer decides the post-holiday price to sell the remaining inventory. We investigate how gift cards change the retailer's ordering and pricing decisions and profitability.

3 - RFID Investment Analysis in the Retail Sector: A Hybrid Model

Narges Kasiri, Oklahoma State University, Hanner 101, Stillwater, OK, United States of America, narges.kasiri@okstate.edu, Ramesh Sharda

RFID adoption is on the agenda for many retailers. In the current economic situation, retail managers need to lower costs and stay competitive in the market more than at any other time. Adoption of RFID may be inevitable, but early adoption has a high cost, as well as many benefits. The question for managers is when the best time to implement this technology is. We combine real options technique with a simulation model to determine the best time to implement this technology in the retail sector.

4 - Channel Strategy with Third Party Logistics

Meng Lu, PhD Candidate, The Chinese University of HK, R615 ERB The CUHK, Shatin, Hong Kong - PRC, mlu@se.cuhk.edu.hk, Houmin Yan

A supply chain consists of a manufacturer, a 3PL and a retailer where 3PL provides emergency replenishment for the retailer. We develop a game model in investigating the dynamics and competitive behavior of the supply chain. Our studies reveal the possibility for the 3PL and the manufacturer's motivation of collaboration in creating a discrimination price, as well the collaboration between the 3PL and the retailer. Our model further demonstrates the supply chain dynamics with 3PL financing.

■ TD53

H-Room 305, Third Floor

Recent Results in Discrete Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Yanjun Li, Purdue University, 403 W. State Street, West Lafayette, United States of America, li14@purdue.edu

1 - Corner Polyhedra and Maximal Lattice-free Sets : A Geometric Approach to Cutting Plane Theory

Amitabh Basu, PhD Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15232, abasu1@andrew.cmu.edu, Gerard Cornuejols, Giacomo Zambelli, Michele Conforti

The Corner Polyhedron, introduced by Gomory in the early 60s, can be viewed as a unifying structure from which most of the known cutting planes in the literature can be derived. It has recently been observed that valid inequalities for the corner polyhedron have an intimate connection with maximal lattice-free convex sets. This connection provides a geometric way of analyzing these valid inequalities. This talk will review some recent theoretical results obtained by us in this area.

2 - Graph Labelings: Analysis of the Covering Problem

Milind Dawande, Professor, University of Texas at Dallas, 800 West Campbell Rd. SM30, School of Management, Richardson, TX, 75080, United States of America, milind@utdallas.edu, R Chandrasekaran, M Baysan

We discuss the covering of a graph by a feasible labeling. Given an undirected graph, two positive integers k and t, and an infinite alphabet, a feasible labeling is an assignment of a set of distinct labels to each vertex of the graph such that (i) the number of labels at a vertex is at most k and (ii) each label is used no more than a total of t times over all vertices. An edge is covered if there is at least one common label at its two end points. The graph is covered if each edge is covered.

3 - Disjunctive Cuts From Lattice-free Convex Sets

Andrea Qualizza, Ph.D. Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qualizza@cmu.edu, Egon Balas

We generate intersection cuts from lattice-free convex sets as lift-and-project cuts from multiple-term disjunctions. The disjunctive hull of a mixed-integer program at a fractional vertex v of its linear relaxation P is the convex hull of points in P satisfying all disjunctions that cut of v but no integer point. We examine the relationship between the disjunctive hull, the corner polyhedron and the integer hull.

■ TD54

H-Room 306A, Third Floor

Geometric Methods in Algorithms and Optimization

Sponsor: Optimization/Networks
Sponsored Session

Chair: James R. Lee, Professor, University of Washington, Department of Computer Science and Engin, Box 352350, Seattle, WA, 98195-2350, United States of America, jrl@cs.washington.edu

1 - Higher Eigenvalues of Graphs

Gregory N. Price, Massachusetts Institute of Technology, 32 Vassar St, Cambridge, MA, 02139, United States of America, price@MIT.EDU, Jonathan Kelner, James R. Lee, Shanghua Teng

We present a general method for proving upper bounds on the eigenvalues of the graph Laplacian. In particular, we show that for any k the k'th smallest Laplacian eigenvalue on a bounded-degree planar graph is O(k/n), which is tight. Similar bounds hold for bounded-genus and forbidden-minor graphs. Previously, such spectral bounds were only known for k=2, i.e. the Fiedler value. In addition our result yields a new, combinatorial proof of the celebrated result of Korevaar in differential geometry.

2 - Sparsest-cut on Surfaces
Anastasios Sidiropoulos, Postdoctoral Fellow, University of Toronto, 10 King's College Road, SF 2302A, Toronto, ON, M5S2R3, Canada, sidiropo@gmail.com, James R. Lee

We give an improved upper bound for max-flow/min-cut ratio of uniform multi-commodity flow on graphs of small genus. In particular, for graphs of genus k we show that this ratio is at most O(log k), improving upon the previously best known bound of O(k), due to Fakcharoenphol-Talwar, and Klein-Plotkin-Rao. Our main technical tool is a decomposition scheme for surfaces with parameters exponentially better in terms of the genus than previous results.

3 - How to Play Unique Games on Expanders
Yury Makarychev, TTI-Chicago, 6045 S. Kenwood Ave, Chicago, IL, 60637, United States of America, ymakarychev@gmail.com, Konstantin Makarychev

In this note we improve a recent result by Arora, Khot, Kolla, Steurer, Tulsiani, and Vishnoi on solving the Unique Games problem on expanders. Given a 1-epsilon satisfiable instance of Unique Games with the constraint graph G, our algorithm finds an assignments satisfying at least a 1- C epsilon/h fraction of all constraints if epsilon < c lambda where h is the edge expansion of G and lambda is the second smallest eigenvalue of the Laplacian of G.

4 - Breaking the Multicommodity Flow Barrier for Approximating Sparsest Cut
Jonah Sherman, UC Berkeley, Soda Hall, University of California, Berkeley, CA, 94720, United States of America, jsherman@EECS.berkeley.EDU

We present an algorithm for the sparsest cut problem that simultaneously achieves the better approximation factor of SDP/multicommodity-flow based algorithms and the subquadratic running time of single-commodity flow based algorithms. The idea is that we can turn Arora, Rao, and Vazirani's matching-chaining argument into an algorithm for finding good augmenting paths in a multicommodity flow network. Our analysis follows ARV's, making essential use of measure concentration on the sphere.

■ TD55

H-Room 306B, Third Floor

Computer Science-OR Applications to CS

Contributed Session

Chair: Larisa Shwartz, Scientist, IBM, T. J. Watson Research Center, 19 Skyline Rd, Hawthorne, NY, 10532, United States of America, lshwart@us.ibm.com

1 - 3D Information Visualization for Multiple Bin Sized Bin Packing Problem
Hande Cardak, CSUF, 1907 Deerpark Dr Apt 520, Fullerton, CA, 92831, United States of America, hande@csu.fullerton.edu, Tugce Gizem Martagan, Gurdal Ertek, Irem Savas

This study presents a software performing 3D visualization of multiple bin sized bin packing problems. The software is capable of visualizing the solution of any bin packing problem in a convenient and user friendly way. A smart bin coloring algorithm is developed and implemented. Visual representation of the solution will enable a better perception of results for academicians and practitioners.

2 - A New Grobner Basis Algorithm to Solve the Inference Problem in Statistical Database Security
Manuel Nunez, Associate Professor, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, mnunez@business.uconn.edu

A major issue in statistical database security is to provide accurate answers to aggregate queries while preventing inference of individual confidential values from the answers. Query restriction methods have been proposed to solve the inference problem for certain types of queries, but the problem is hard to solve for general non-linear queries dealing with numerical and categorical data. We present a new query restriction method based on Grobner basis theory to solve the inference problem.

3 - Application Effects of Concurrent Engineering in Computer Designing of Processes
Eric Dragan, CAD/CAM Engineer, SLOBODA, Ratka Mitrovic b.b., 32000 Cacak, 32000, Serbia-Montenegro, ericmdragan@yahoo.com, SVETISLAV MARKOVIC

Concurrent engineering represents fully integrated and parallel aproach to all the elements of designing. Our work connects development department and development of suitable processes alongwith the application of modern software tools for CAD,CAM,CAE and VE (Virtual Engineering). These parallely integrated systems make the system of Concurrent engineering increasingly efficient in comparison to systems of sequence design engineering.

4 - Cyberspace Villains: Piracy in Bits and Bytes
Janet Scott, Student, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, jscott7@alumni.savannahstate.edu, Ulysses Brown

The advent of the internet has transformed global business practices. However, in some instances these transformations are detrimental to specific industries, especially the music industry. Now music lovers can freely download songs and videos without paying artists and record companies. This paper examines the downloading behavior of research participants.

5 - Formalization of the SPC Service Delivery Process
Larisa Shwartz, Scientist, IBM, T. J. Watson Research Center, 19 Skyline Rd, Hawthorne, NY, 10532, United States of America, lshwart@us.ibm.com, Genady Grabarnik

A Service Provider Coalition is a group of providers that together supply a composed service and have group authority and responsibility to consumers of their services. Effective management of service delivery by SPC requires a cooperative service management information system as the communications medium across providers' organizations. We build probabilistic model of SPC delivery process where nodes represent services which we may treat as atomic services executed by a single provider.

■ TD56

H-Room 307, Third Floor

Algorithms and Applications for Compressed Sensing

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu

1 - An Alternating Direction Augmented Lagrangian Framework for Convex Semidefinite Programming
Shiqian Ma, Columbia University, 500 W. 120TH ST, Mudd Building, RM 313, New York, NY, 10027, United States of America, sm2756@columbia.edu, Donald Goldfarb, Zaiwen Wen, Katya Scheinberg

We present an alternating direction augmented Lagrangian framework for convex semidefinite programming problems. The convergence of the presented method is established. Numerical results for solving several types of sparse covariance selection problems are reported.

2 - A First-order Penalty Method for Compressed Sensing
Necdet Aybat, IEOR Deptartment Columbia University, IEOR Department Rm. 313, SEAS, Columbia Uni., 500 West 120th St., New York, NY, 10027, United States of America, nsa2106@columbia.edu, Garud N. Iyengar

The proposed algorithm efficiently solves min |x|_1 st Ax=b. We do not require A*A = I. Hence, it can be used to recover compressed CT scans, A*A = I doesn't hold.At each iterate x_k the extent of suboptimality and infeasibility is bounded. For any e, algorithm computes x_sol that is e-feasible i.e. |Ax_sol-b|_2 < e and e-optimal, ||x_sol|_1 - |x*|_1| < e, in O(1/e) time without tuning the parameters for the given e. It can be extended to solve the relaxed recovery min |x|_1 st. |Ax-b|_2 <= e.

3 - FPC_AS: A Fast Algorithm for Sparse Reconstruction Based on Shrinkage and Subspace Optimization
Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Wotao Yin, Donald Goldfarb, Yin Zhang

We describe a fast algorithm for sparse reconstruction. The algorithm is divided into two stages that are performed repeatedly. In the first stage, "shrinkage" yields an estimate of the subset of variables likely to be nonzero in an optimal solution. Subspace optimization are then used to recover the magnitude of the solution in the second phase. Our implementation of this method exhibits state-of-the-art performance both in terms of its speed and its ability to recover sparse signals.

4 - Gradient Methods for Non-smooth Optimization with Applications to L1-minimization
Zhaosong Lu, Assistant Professor, Simon Fraser University, Department of Mathematics, Burnaby, BC, Canada, zhaosong@sfu.ca, Yong Zhang

In this talk, we study gradient methods for a class of non-smooth optimization problems. Then we discuss the application of these methods to a few well-known L1-minimization problems arising in science and engineering such as compressed sensing. Some preliminary computational results are finally presented.

■ TD57

H-Room 308, Third Floor

RFID/Sensor Data in Healthcare Operations

Sponsor: Health Applications
Sponsored Session

Chair: Daiki Min, PhD Candidate, School of Industrial Engineering, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, dmin@purdue.edu

1 - Equipment Management with RFID in Healthcare
Nebil Buyurgan, University of Arkansas, 4107 Bell Engineering Bld., Fayetteville, AR, 72701, United States of America, nebilb@uark.edu

An analysis of portable equipment management in hospital environments is presented. Considering the significant amount of personnel time for equipment search, a simulation-based decision support tool is developed to analyze tracking activities for different equipment. In addition, the impact of RFID technology on the widely-adopted management models is also studied. Using the search time for an item as a performance measure, better and improvable system configurations are identified.

2 - A Markov Chain Model for Quantifying the Value of Information From an RFID Tracking System
Xiuli Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, xqu@ncat.edu, LaKausha Simpson, Paul Stanfied

This paper proposes a Markov chain model to capture the states of critical hospital equipment. A sensitivity analysis is conducted to assess the impact of demand, searching efficiency, and maintenance policy alongside the use of an active RFID-enabled equipment tracking system. Performance is assessed in terms of operational costs and lost-of-service costs. The key finding is that the performance is most sensitive to the presence of an RFID system.

3 - An Intelligent Infrastructure For Healthcare
Edmund W. Schuster, Research Engineer, Auto-ID Labs, MIT, 77 Massachusetts Av., 35-135A, Cambidge, MA, 02139, United States of America, edmund_w@mit.edu

The vision of the EPCglobal Network and RFID technology is to provide continual access to the identity, location, and the state of physical objects. While much of the focus of RFID technology has concentrated on supply chain management, there remain significant opportunities for implementing the EPCglobal network in healthcare. This talk concentrates on RFID applications along with corresponding mathematical models to improve healthcare efficiency.

4 - Fuzzy Logic-based Algorithms for Detecting RFID Tag in an Outpatient Eye Clinic
Daiki Min, Ph.D. Candidate, School of Industrial Engineering, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, dmin@purdue.edu, Yuehwern Yih

In this paper, fuzzy logic-based algorithms are proposed to accurately locate the RFID tag in an outpatient eye clinic when the RFID reader is unreliable. The proposed algorithms determine the presence or absence of the RFID tag by evaluating its possibility of presence and possibility of absence. The experiment results show that the proposed algorithms outperform the existing static smoothing methods.

■ TD58

H-Room 309, Third Floor

OutSourcing and Subcontracting Games

Cluster: Scheduling
Invited Session

Chair: George Vairaktarakis, Case Western Reserve University, Weatherhead School of Management, Department of Operations, Cleveland, OH, 44106, United States of America, gxv5@case.edu

1 - Cooperation and the On-time Processing of Outsourced Operations
Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu, Xiaoqiang Cai, George Vairaktarakis

Online booking systems for reserving third-party processing capacity are increasingly used by companies that engage in manufacturing outsourcing. The current practice allows the customers of a third-party to update initial bookings and even cooperate with other customers to achieve significant savings. In this paper, we analyze the coordination issues that arise in such a setting, and provide transfer payment schemes that promote full cooperation of the customers as well as the third-party.

2 - Coordination of Outsourced Operations Subject to Booking, Overtime, and Tardiness Penalties
Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Dept of Systems Eng & Eng Management, Hong Kong, Hong Kong - PRC, xqcai@se.cuhk.edu.hk, George Vairaktarakis

A group of manufacturers outsource jobs to a single third-party subject to booking, overtime, and tardiness costs. We propose a coordination model based on a cooperative game, which creates a win-win solution to all.

3 - Coordination of WIP Costs in Subcontracted Operations
George Vairaktarakis, Case Western Reserve University, Weatherhead School of Management, Department of Operations, Cleveland, OH, 44106, United States of America, gxv5@case.edu, Xiaoqiang Cai

Consider m players each subcontracting part of his operations to a single third-party, with the objective of minimizing his total flowtime. When the players book third-party capacity in a first-come-first-book order, the resulting schedule at the third-party is socially inefficient. We study cooperative games and incentive systems that make it more profitable for all players to coordinate towards the centralized optimum than their individual optimal strategy.

■ TD59

H-Room 310, Third Floor

Tutorial: Fractional Programming with Applications

Cluster: Tutorials
Invited Session

Chair: Siegfried Schaible, Chung-Yuan Christian University, No. 200, Chung Pei Road, Chung Li, Taiwan - ROC, schaible2008@gmail.com

Co-Chair: Ruey-Lin SheuProfessor, National Cheng Kung University, No. 1, University Road, Tainan, Taiwan - ROC, rsheu@mail.ncku.edu.tw

1 - Fractional Programming with Applications
Siegfried Schaible, Chung-Yuan Christian University, No. 200, Chung Pei Road, Chung Li, Taiwan - ROC, schaible2008@gmail.com, Ruey-Lin Sheu

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

■ TD60

H-Room 311, Third Floor

Multivariate Polynomial Optimization: Theory and Algorithms

Cluster: Theory, Algorithms and Applications of Convex Cone Programming
Invited Session

Chair: Jiawang Nie, UCSD, 9500 Gilman Drive, La Jolla, CA, United States of America, njw@math.ucsd.edu

1 - Which Convex Sets are Expressible by Semidefinite Programming ?
J. William Helton, Professor, UCSD, 9500 Gilman Drive, La Jolla, United States of America, Helton@math.ucsd.edu, Jiawang Nie

There are three natural directions this problem can take. The first one is what convex sets can be represented by linear matrix inequality (LMI). The second direction is whether this can be done when the variables are matrices of arbitrary dimensions. The last one is what convex sets are LMI represented by adding auxiliary variables, which is also called semidefinite programming (SDP) representable.

2 - A Convex Polynomial that is Not SOS-convex
Amir Ali Ahmadi, MIT, 195 Binney st., Apt. #4401, Cambridge, MA, 02142, United States of America, a_a_a@mit.edu, Pablo A. Parrilo

The algebraic notion of sos-convexity has recently been proposed as a sufficient condition for convexity of polynomials based on semidefinite programming. Motivated by its computational tractability, it has been speculated whether sos-convexity is also a necessary condition for convexity of polynomials. In this paper, we give a negative answer to this question by presenting an explicit example of a trivariate homogeneous polynomial of degree eight that is convex but not sos-convex.

3 - A New SDP Approach to the Max-cut Problem
Joao Gouveia, University of Washington, Department of Mathematics Box 354350, Seattle, WA, 98105, United States of America, jgouveia@u.washington.edu, Monique Laurent, Pablo A. Parrilo, Rekha R. Thomas

Using sums-of-squares techniques we develop a new hierarchy of SDP relaxations for the Max-Cut problem, solving an open question by Laszlo Lovasz.

4 - SDP Representation of Rational and Singular Convex Sets
Jiawang Nie, UCSD, 9500 Gilman Drive, La Jolla\, United States of America, njw@math.ucsd.edu, J. William Helton

A set is called SDP representable if it is expressible by some linear matrix inequality via lifting variables. First, we will present a general result: A set S defined by polynomial inequalities is SDP representable if its boundary pieces are nonsingular and positively curved. Second, we will present conditions for SDP representability when S is defined by multivariate rational polynomial functions or its boundary pieces have singularities. Specific examples will also be shown.

■ TD61

H-Room 312, Third Floor

Humanitarian Logistics

Contributed Session

Chair: Yan Yan, Northeastern University, Northeastern University,ShenYang,China, Shenyang, China, yanyan8262@126.com

1 - Stochastic Collaborative Humanitarian Relief Supply Chain Network Based on Multi-objective Criteria
Daniel Mota, Graduation Student, NCAT, 400 B Montrose Dr., Greensboro, NC, 27407, United States of America, danielmota.producao@gmail.com, Lauren Davis

Effectiveness is the primary goal in a humanitarian supply chain.Using Markov chain theory we developed a representation of the various sources of uncertainties present in a multi-supplier network during a disaster. A non-stationary model investigates the supply profile over the humanitarian relief life cycle and the impact on the network if backup supplier is used. Measured by a multi-criteria structure, we investigate the impact of the warehouses capacity on the victims assistance rate.

2 - A Supply Chain Emergency Dispatch Problem under Node Fails and Limited Resource
Yan Yan, Northeastern University, Northeastern University,ShenYang,China, Shenyang, China, yanyan8262@126.com, Liu Xiao

this paper addresses the emergency dispatch problem when one of the nodes fails. An optimal model is developed under constraints of limited resource to minimize the total cost. The simulation results indicate validity and practicability of the emergency dispatch solution using CPLEX.

■ TD62

H-Room 313, Third Floor

Teamwork and Communication

Contributed Session

Chair: Timothy L. Urban, Professor, The University of Tulsa, Operations Management, 800 South Tucker Drive, Tulsa, OK, 74104, United States of America, urbantl@utulsa.edu

1 - Sequential Analysis of Team Communication Patterns
Rebecca Perryman, Graduate Student, Texas A&M University, 2250 Dartmouth #412, College Station, TX, 77840, United States of America, rhaas@neo.tamu.edu, Sara McComb

Humans use mental models to understand their surroundings. In teams, the team members' mental models converge over time and become similar. The way this process unfolds, however, has not been examined. Herein, we use sequential analysis to examine team communication patterns. Results and implications are discussed.

2 - A Genetic Algorithm Approach to Optimizing Team Communication Processes
Deanna Kennedy, Doctoral Candidate, University of Massachusetts Amherst, Isenberg School of Management, 121 Presidents Drive, Amherst, MA, 01003, United States of America, dkennedy@som.umass.edu, Sara McComb

The search for team communication processes that achieve the best time and cost performances poses a multi-objective combinatorial optimization problem. In this paper, the problem was solved using a genetic algorithm approach that evolves strings of communication exchanges to find the optimal way in which the communication process should unfold among team members. Research and practitioner implications are discussed.

3 - Environmental Uncertainty and Teamwork: Effects of Changing Task Parameters on Team Outputs
Sara McComb, Associate Professor, Texas A&M University, Zachry Engineering Center, Room 237B, 3131 TAMU, College Station, TX, 77843, United States of America, mccomb@tamu.edu, Deanna Kennedy

Most teams face uncertain working conditions as they complete their assigned task. To investigate how teams respond to such uncertainty, we use longitudinal data, collected at the end of performance episodes, to examine the impact of changing task parameters on the teamwork processes of computer-mediated and face-to-face teams. Results and implications are discussed.

4 - The Social Power Networking Problem
Timothy L. Urban, Professor, The University of Tulsa, Operations Management, 800 South Tucker Drive, Tulsa, OK, 74104, United States of America, urbantl@utulsa.edu, Robert Russell

A social-networking problem is under consideration in which local professionals attend a function to meet other individuals in the business community. This combinatorial problem involves maximizing the minimum number of unique contacts made by each individual by assigning over 200 individuals, 10 at a table, for 5 rotations (hence, an individual can make up to 45 contacts). Bounds are developed and solution methodologies using constraint programming and mixed-integer programming are presented.

■ TD63

H-Room 314, Third Floor

Process Analysis in Health Care I

Contributed Session

Chair: Michael Samsa, Decision Support and Risk Management Group Leader, Argonne National Laboratory, 9700 South Cass Avenue, Building 900, Argonne, IL, 60439, United States of America, msamsa@anl.gov

1 - A Case Study of a Physical Examination Service in Taiwan
Wheyming Song, Tsing Hua University, 1001, Hsinchu, Taiwan - ROC, wheyming@ie.nthu.edu.tw

The objective of our project is to improve the efficiency of the Physical Examination (PE) service of a large hospital system in Taiwan. The efficiency is measured by patient wait time and physician utilization. A traditional approach would be to identify and evaluate an optimal solution. This paper focuses on an ideal solution rather than an optimization. We start with a simulation model, then discuss the optimal and ideal solutions based on the simulation model.

2 - Effect of Arrival Punctuality on the Interarrival Time of Queues that Schedule Appointments
Trent Larson, PhD Student, Walden University, 100 Revolution Drive, Leominster, United States of America, tlaelarson@verizon.net

What are the effects of arrival punctuality on queues that schedule arrivals to processes? Different interarrival time distributions are caused by the interaction between different types of arrival punctuality distributions and the time scheduled between appointments. The effects of punctuality distribution parameters are explored including: standard deviation, mean offset to appointment time, skewness, and punctuality distribution type.

3 - Detailed Time-in-motion Study of Three Diverse Mass Vaccination Clinic Operations
Michael Samsa, Decision Support and Risk Management Group Leader, Argonne National Laboratory, 9700 South Cass Avenue, Building 900, Argonne, IL, 60439, United States of America, msamsa@anl.gov, Matthew Berry

Argonne's Clinic Time-in-Motion Study Protocol employs synchronized hand-held electronic data collection devices to measure the start and finish time of each server's interaction with each patient. This protocol was applied in three diverse clinic settings and demonstrated a significant improvement in accuracy over methods recommended by CDC. Factors affecting patient throughput are statistical distributions of process steps are discussed. A model for optimizing clinic operations is shown.

■ TD64

H-Room 202A, Second Floor

Education II

Contributed Session

Chair: Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

1 - Antecedents of Faculty Evaluations: The Role of Grade Expectations

Shalonda Bradford, Lecturer, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, bradfors@savannahstate.edu, Ulysses Brown

This research examines the antecedents of student evaluations of faculty in several business courses. We used latent variable modeling to evaluate the hypotheses. Findings indicate that grade expectations influence student evaluation of faculty. We discuss implications, limitations, and future research suggestions.

2 - Enlightening College Students: Determinants of Advisor Satisfaction and Academic Support

Ulysses Brown, Assistant Professor of Management, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, brownu@savannahstate.edu, Joycelyn Finley-Hervey, Ruby Beale

This research examines the antecedents of academic support and advisor satisfaction among college students. Although not appealing to some professors, academic advising remains an important function of the Academy. Advising quality may determine whether students graduate in four years. Our findings reveal gender differences across the nomological network.

3 - Applied Capstone Course Design Elements: Pedagogical and Practical Considerations

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

The University of Dayton Operations Management Department has offered a highly successful capstone course in OM for seven years on 48 projects and 140 students. This talk discusses the practical and pedagocial considerations for offering a project course that applies O.R. skills to actual corporate clients. We discuss the benefits to the constituencies: faculty, students and client.

■ TD65

H-Room 202B, Second Floor

Joint Session WORMS/JFIG: Panel Discussion: What I Wish I Had Known: PhD Years and Beyond

Sponsor: Women in OR/MS & Junior Faculty Interest Group

Sponsored Session

Chair: Natalie Privett, PhD Candidate, Stanford University, Department of Management Science & Engin, Production & Operations Management, Stanford, CA, 94305, United States of America, nprivett@stanford.edu

Co-Chair: John Khawam, Stanford University, Stanford, CA, 94305, jkhawam@stanford.edu

1 - What I Wish I Had Known: PhD Years and Beyond

Moderator: Natalie Privett, PhD Candidate, Stanford University, Department of Management Science & Engin, Production & Operations Management, Stanford, CA, 94305, United States of America, nprivett@stanford.edu, Panelists: Candi Yano, Alexandra Newman, Elizabeth Durango-Cohen

Find out what you don't know you don't know in this multi-generational panel covering topics ranging from the Ph.D. job search to the future of OR/MS ; from the tenure process to life as an academic with kids. Feel free to bring your own questions, or just come and listen to sage advice and personal testimony.

■ TD66

H-Room 204A, Second Floor

Financial Engineering Models and Applications

Sponsor: MSOM/ iFORM

Sponsored Session

Chair: Farid AitSahlia, Risk Management and Financial Engineering Lab., University of Florida, Gainesville, United States of America, faitsahlia@gmail.com

1 - Optimal Operating Control and Dividend Distribution Policies

Rene Caldentey, Associate professor, New York University, rcaldent@stern.nyu.edu, Cristobal Correa

We consider a firm whose net earnings evolve according to a Brownian motion which is influenced by the firm's operating strategy. The firm has to decide on the optimal operating policy (controling the drift of the earnings process) as well as the leverage ratio and the distribution of dividends.

2 - Pricing and Hedging of Discretely Monitored Asian Options

Gudbjort Gylfadottir, Industrial and Systems Engineering, University of Florida, gudbjort@gmail.com, Farid AitSahlia

Asian options (with arithmetic average) are critical to control commodity prices and exchange rates fluctuations faced by corporations. We make use of quantile options to approximate the prices and hedge parameters of such options when the underlying is assumed to follow a Levy process.

3 - Estimating Distributions with Entropy Approach: Two Case Studies

Konstantin Kalinchenko, Doctorial Candidate, Risk Management and Financial Engineering lab, Department of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, kalinchenkok@gmail.com, Stan Uryasev

We are using entropy approach for calibrating probabilistic distributions. The first problem is related to estimating return distributions of a portfolio based on information from analysts. The second problem is from medical area where we are estimating the risk (probability) of cesarean section.

■ TD67

H-Room 204B, Second Floor

Data Envelopment Analysis: Methodology

Cluster: Data Envelopment Analysis

Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu

1 - lu-Substitutability, Slacks and Data Envelopment Analysis

Andy Johnson, Assistant Professor, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, United States of America, ajohnson@tamu.edu, John Ruggiero

In DEA analysis remaining slacks have posed a problem in efficiency evaluation, because the nonparametric method does not assure a Koopmans efficient benchmark. We relax the free disposability assumption with the introduction of the Œμ-substitutability postulate imposing positive marginal rates of technical substitution. We then show that Debreu-Farrell efficiency is sufficient to quantify inefficiency under the minimum extrapolation postulate.

2 - Reconfiguration for Improving Efficiency of Branches

Hiroshi Morita, Osaka University, 2-1 Yamadaoka, Suita, Japan, morita@ist.osaka-u.ac.jp

Assume that the company has several branches, each of which has disjoint business territory. The managerial efficiency depends on the characteristics of territory. We consider the reconfiguration of branches to keep the efficiency of efficient branches, and at the same time, to improve the efficiency for inefficient branches.

3 - Three Stage DEA Models for Incorporating Exogenous Inputs
John Ruggiero, John.Ruggiero@notes.udayton.edu, Sarah Estelle, Andy Johnson

In this paper, we discuss three-stage models that control for exogenous, non-discretionary inputs in data envelopment analysis. In a recent journal article, Monte Carlo analysis was employed to compare and contrast alternative DEA models that measure efficiency in the presence of exogenous variables. The methodology for comparison was flawed, calling into question the presented results. We introduce new second-stage models and compare and contrast them with simulated data.

4 - An Essay on Pareto-Koopmans Efficiency in DEA
Kaoru Tone, Professor, National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677, Japan, KaoruTone@aol.com, Miki Tsutsui

Firstly, we discuss differences between Farrell and Pareto-Koopmans efficiency measures in DEA, and propose a method for discriminating them. Then, we extend the method to so-called 'epsilon based-measure (EBM).' The EBM can check the robustness of efficiency measure of DMUs regarding the virtual input or output weights.

■ TD68

H-Room 206, Second Floor

Sampling and Scenarios in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Stochastic Online Optimization of Hybrid Energy Systems
Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

We study the potential of applying systematic stochastic optimization techniques to managing hybrid energy systems such as solar-driven systems. We present a technique of computing and incorporating complete probability distribution of weather forecast uncertainty in a stochastic optimization framework. We demonstrate that significant economic benefits can be realized through the proposed developments.

2 - Multi-Stage Robust Lot-Sizing Problems
Yongpei Guan, Assistant Professor, Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu, Zhili Zhou

In this paper, we consider robust lot-sizing problem as an example to analyze multi-period robust integer optimization problems. Our objective is to provide a robust schedule for a multi-stage robust integer programming problem. Several cases are studied and corresponding algorithms are developed. Our preliminary study verifies the effectiveness of our approaches.

3 - Rate of Convergence in Scenario Approximation Using the Sparse Grid Method
Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, Michael Chen

Recently we have proposed the use of a sparse grid method for scenario generation in stochastic programming. We will present rate of convergence results for the sparse grid scenario generation method in stochatic programming. In particular, we show that for problems with expectation only in the objective and sufficient differentiability the rate of convergence is similar to that for integration problem.

■ TD69

H-Indigo A, Second Floor

Forecasting

Contributed Session

Chair: Tao Hong, Senior Engineer, Quanta Technology, 4020 Westchase Blvd, Suite 300, Raleigh, NC, 27607, United States of America, hongtao01@gmail.com

1 - The Demand for Money within a Supply and Demand Framework
Abul Jamal, Professor, Southeastern Louisiana University, Department of Management, Hammond, LA, 70402, United States of America, ajamal@selu.edu, Yu Hsing

The Demand for Money has been a subject of extensive analysis. Most researches however, estimate the demand function without considering the supply function as well. The purpose of this paper is to estimate the demand for money within a model where the supply function is also estimated simultaneously. The results should be useful to both macroeconomic researchers and policymakers.

2 - The Extended Diffusion Model to Forecast Demands of the New Multi-item Products
Jaehun Jung, PhD Student, Korea University, Anam-Dong Seongbuk-Gu, KUBS Main Building #516, Seoul, 136-701, Korea, Republic of, kafa7@korea.ac.kr, Daeki Kim

Demand forecast for new products is normally using the diffusion model; however, it is very difficult to forecast demands of new multi-item products. In this research, we extend the diffusion model with three additional parameters. We calibrate parameters for the products with historic data, or estimate parameters based on characteristics of products that have no historical information.

3 - Generating Random Walks for Time Series Forecasts through Monte Carlo Simulation
Samik Raychaudhuri, Sr. Member of Technical Staff, Oracle Inc., 4001 Discovery Drive, Suite 340, Boulder, CO, 80026, United States of America, samikr@gmail.com

Time series forecasting with simple methods is used heavily by academicians and practitioners alike for making decisions. Typically running a time series model on a historical data yields the base case forecasts. One might consider including the risks associated with this forecast, and consider a random walk model for simulating different scenarios. In this presentation, we discuss various options for performing Monte Carlo simulation with forecasts, and present some promising results.

4 - Electric Load Forecasting: Two Perspectives
Tao Hong, Senior Engineer, Quanta Technology, 4020 Westchase Blvd, Suite 300, Raleigh, NC, 27607, United States of America, hongtao01@gmail.com, Simon Hsiang, Pu Wang

Electric load forecasting is a well-known problem in the energy industry. Many methodologies could solve the problem theoretically; however, the solutions are quite different in practice. This paper presents various load forecasting problems and their solutions, to illustrate the difference between normative and positive perspectives.