Monday, 8:00am - 9:30am

■ MA01

C-Room 21, Upper Level

Innovation at the Frontiers of Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Jim Felli, Research Fellow, Eli Lilly & Co., Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, jcfelli@lilly.com

1 - Prioritizing Organizational Shortfalls: 'Gap Analysis' Using Multi-criteria Decision Analysis

Lawrence Phillips, Professor, London School of Economics & Political Science, 1 Ladywell Court, 22 East Heath Road, London, NW3 1AH, United Kingdom, larry_phillips@msn.com

This paper reports a case study of an MCDA approach to 'gap analysis' The method was applied in a decision conference of knowledgeable and senior key players, who used a mixture of performance data and judgment to prioritize key organizational capabilities according to the size and importance of the differences between desired and current performance. This established the key areas for considering measures to close the gaps.

2 - Decision Science and Alliance Management Fusion

David Thompson, Chief Alliance Officer, Eli Lilly & Co., Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, thompson_david_s@lilly.com, Jim Felli

The unlikely blending of Decision Science with Alliance Management results in a powerful tool for gaining clarity around pharmaceutical product development with allied products. The combination of these two disciplines results in a novel approach to gaining an aligned vision for product development, and a unique team building experience.

3 - Thinking Clearly About Decisions

Ralph Keeney, Professor, Duke University, 101 Lombard St., #704W, San Francisco, CA, 94111, United States of America, keeney@duke.edu

The numerous concepts used in decision analyses are essential to clear thinking about any important decision. However, numerous decision makers and individuals who influence important decisions are not aware of or do not understand many of these concepts. This paper specifies several of these relevant concepts, presents cases indicating the lack of understanding of such concepts by decision makers, and suggests the challenges and opportunities for improvement.

■ MA02

C-Room 22, Upper Level

The Role of Some Functional Equations in Decision Analysis and the Impact of Janos Aczel

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu

1 - The Role of Functional Equations in Utility Theory

Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu, Janos Aczel

Functional equations have played an essential role in the characterization of utility and probability functions in decision analysis. We reflect on some equations that have led to the notions of the "delta property", extensions of the delta property to multiple attributes, and the notions of one-switch utility functions and conditional utility independence.

2 - Functional Equations in Individual Decision Theory: Some of Janos Aczel's Impact

Duncan Luce, Distinguished Research Professor, UC Irvine, Social Science Plaza, Irvine, CA, 92697-5100, United States of America, rdluce@uci.edu

Following general remarks about Aczél's interplay with the behavioral and social sciences, the focus turns to roles of functional equations in decision theory. A basic observation is that when two axiomatized structures have a common attribute-in this case, preferences-and each structure yields an order-preserving measure of that attribute, we ask: when are the measures the same measure? This translates into a functional equation. Examples are presented where Aczel's ideas were essential.

3 - The Role of Functional Equations in Probable Inference

Janos Aczel, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, jdaczel@math.uwaterloo.ca

Cox's Algebra of Probable Inference appeared in 1961. Jaynes wrote it is "the most important ever written about the foundations of probability theory and the greatest advance in the conceptual, as opposed to the mathematical, formulation of the theory since Laplace". In 1963 a paper of Aczel appeared, pointing out a small blemish in Cox's book. I describe that blemish and also show why it is not fatal -I also mention a problem of R.D.Luce and its solution with few regularity assumptions.

■ MA03

C-Room 23A, Upper Level

Game Theory for Engineering Systems

Cluster: Game Theory
Invited Session

Chair: Jason Marden, Junior Fellow, California Institute of Technology, M/C 136-93, Pasadena, CA, 91125, United States of America, marden@caltech.edu

1 - On Multi-Dimensional Envy-Free Mechanisms

Ahuva Mu'alem, Junior Fellow, California Institute of Technology, M/C 136-93, Pasadena, CA, 91125, United States of America, ahumu@yahoo.com

We consider fairness design scenarios in which each bidder follows the global goal of the mechanism designer only if the resulted allocation is fair from his own point of view. More formally, we focus on approximation algorithms for indivisible items with supporting envy-free bundle prices. We study the canonical problem of makespan-minimizing unrelated machine scheduling in an envy-free manner. Tight algorithmic bounds are given for the special interesting case of related machines.

2 - Attaining Efficiency with P2P Content Distribution

Srinivas Shakkottai, Assistant Professor, Texas A&M University, 332C WERC, College Station, TX, 77843-3128, United States of America, sshakkot@tamu.edu

Large amounts of traffic exchange between ISP boundaries has caused a misalignment of incentives between P2P networks-that seek to maximize user quality-and ISPs-that seek to minimize costs. We first design an architecture that allows the alignment of such objectives. Second, we study real-time applications requiring distribution of content chunks with delay constraints. We develop chunk selection algorithms that attain such guarantees. Joint with L. Ying, R. Srikant, A.L.N. Reddy, V. Reddy, Y. Kim.

3 - Distributed Welfare Games

Jason Marden, Junior Fellow, California Institute of Technology, M/C 136-93, Pasadena, CA, 91125, United States of America, marden@caltech.edu, Adam Wierman

In the traditional resource allocation problem, there is a global planner who would like to assign a set of players to a set of resources so as to maximize welfare. We consider the situation where the global planner does not have the authority to assign players to resources; rather, players are self-interested. We focus on understanding how the global planner can entice the players to settle on a desirable allocation.

4 - Overcoming Limitations of Game-theoretic Distributed Control

Adam Wierman, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, adamw@caltech.edu, Jason Marden

Recently, non-cooperative game theory has been proposed as a tool for cooperative control. In this work, we prove that this approach has limitations, e.g., we prove that it is not possible to design budget balanced agent utilities that also guarantee that the optimal control is a Nash equilibrium. However, we also demonstrate that these limitations can be overcome by moving to the framework of stochastic games.

■ MA04

C-Room 23B, Upper Level

Procurement Auctions

Cluster: Auctions
Invited Session

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

1 - A Truthful Bundle/Multiunit Double Auction
Leon Chu, leonyzhu@usc.edu

We address the mechanism design problem for a market with multiple buyers and sellers. Each buyer demands bundles of various goods; each seller supplies multiple units of one good. A padding mechanism is proposed to find the buying prices. After that, the selling prices are calculated via a VCG scheme subject to a tariff. To the best of our knowledge, this mechanism is the first strategy-proof, individually rational, weakly budget-balanced double auction mechanism for the specified environment.

2 - Bertrand-Edgeworth Auction with Multiple Asymmetric Bidders
Shanshan Hu, Assistant Professor, Indiana University at Bloomington, hush@indiana.edu, Roman Kapuscinski, William Lovejoy

A unit-price discriminatory procurement auction is equivalent to a Bertrand-Edgeworth (B-E) game with inelastic demand. We characterize the equilibrium structure for B-E auctions with multiple asymmetric bidders. A closed-form solution of mixed-strategy equilibrium is derived for a game with similar bidders, and a numberical algorithm is contructed for more general cases. Numerical studeis illustrate the structural impacts of suppliers' capacities and costs in their procurement bidding.

3 - Reverse Auction Procurement with Flexible Noncompetitive Contracts
Sean Zhou, The Chinese University of Hong Kong, Room 609, William M. W. Mong Engineering, Shatin, N.T, Hong Kong - PRC, zhoux@se.cuhk.edu.hk, Zhijie Tao, Gangshu Cai, Nianbing Zhang

We consider a model that a buyer procures multiple units of a certain product from a group of suppliers. The buyer adopts a hybrid procurement mechanism, in which she first offers some flexible noncompetitive contracts to suppliers followed by a reverse auction. We show that the selected supplier may prefer to accept the offer and the buyer can benefit from offering such contracts

4 - Right of First Refusal (ROFR) in Procurement Auctions
Ali Pilehvar, PhD Student, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20740, United States of America, a_pilehvar@yahoo.com, Manu Goyal, Wedad Elmaghraby

In many procurement auctions, buyers grant the 'right of first refusal' or 'ROFR' to their favored supplier (e.g. incumbent in many cases) rather than selecting the winner based on the lowest bid. Within a simple environment consisting of a buyer and two suppliers (an incumbent and an entrant), we show that such ROFR always hurts the buyer in a single auction. However, with a looming second auction in the future (with the same participating suppliers), the buyer may benefit by granting the ROFR to the incumbent supplier. Our results help explain a commonly seen ROFR in procurement auctions.

■ MA05

C-Room 23C, Upper Level

Joint Session QSR/SIM: QSR and Simulation

Sponsor: Quality, Statistics and Reliability & Simulation
Sponsored Session

Chair: Hong Wan, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, hwan@purdue.edu

1 - Simulation Study of the Response Surface of the Liver Transplantation Allocation Policy
Wen-Hsin Feng, Purdue University, 315 N Grant Street, West Lafayette, IN, 47907, United States of America, wfeng@purdue.edu, Nan Kong, Hong Wan

The liver allocation policy is critical but very complex to develop. We identify four major factors for ranking the patients and propose a single score system to capture alternative prioritization schemes. We simulate the allocation system and incorporate mixture designs to construct response surfaces of different performance measures. This can help the policy makers to systematically comprehend the performance of different policies and explore their robustness upon the environment's changes.

2 - Design of Experiments for Stochastic Kriging
Bruce Ankenman, Professor, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, ankenman@northwestern.edu, Mustafa Tongarlak, Barry L Nelson

Stochastic Kriging is a recently introduced method for creating metamodels for discrete event simulation output. We will study various sequential design strategies to support stochastic kriging. The sequential strategies build on the Latin hypercube designs commonly used for deterministic surface building with ordinary kriging. Since stochastic kriging assumes non-constant variance across the surface, both design point locations and number of replications per design point are considered.

3 - Applied Experimental Design for an Autonomous Search Simulation
Rachel Johnson, Assistant Professor, Naval Postgraduate School, 1411 Cunningham Rd, GL - 253, Monterey, 93940, United States of America, rtjohnso@nps.edu, Timothy Chung

Simulation of persistent surveillance in maritime and land scenarios is used to provide valuable insight about the factors that influence the interception rate of targets. We present an experimental design approach to study the effect of search strategies, false negative and positive detection and identification probabilities, and other factors relevant to autonomous multi-agent systems. The results of the screening experiment will guide field trials for the NPS, USSOCOM program.

4 - Good Experiment Designs for Fitting Forward-Inverse Metamodels
Russell Barton, Professor, Smeal College of Business, Penn State, 406 Business Building, University Park, PA, 16802, United States of America, rrb2@psu.edu, Max Morris

When simulations produce multiple measures of performance, the same set of data used to fit (forward) metamodels may be used to fit approximations for inverse functions as well. Inverse metamodels are useful for product or process design. We discuss measures of goodness and construction strategies for experiment designs that can be used to fit both forward and inverse metamodels.

5 - Multivariate Modeling for Calibration of a Gas Sensor Array
Feng Yang, Assistant Professor, West Virginia University, P.O. Box 6070, Morgantown, 26505, United States of America, fengyang08@gmail.com, Nick Wu

A gas sensor array is a set of sensors typically designed to provide multi-sensor signals for the identification of gaseous analytes. A quantitative relationship between the gas concentrations and sensor signals is desired for the purpose of inferring gas concentrations from sensor responses in practical use. To achieve such high-quality functional relationships in a data efficient manner, design of experiments strategies are developed, and particular statistical inference methods are adopted.

■ MA06

C-Room 24A, Upper Level

IIE Transactions on Quality and Reliability Engineering Sponsored Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jianjun Shi, The Carolyn J. Stewart Chair Professor, Georgia Institute of Technology, 765 Ferst Drive, Room 214, Atlanta, GA, 30332, United States of America, jianjun.shi@isye.gatech.edu

1 - Gaussian Process Method for Form Error Assessment Using Coordinate Measurements
Yu Ding, Associate Professor, Texas A&M University, 3131 MS, College Station, TX, 77843, United States of America, yuding@iemail.tamu.edu, Heidi Xia, Jyhwen Wang

This paper presents a Gaussian process method for modeling and assessing form errors. The GP method models both the systematic and random manufacturing errors of a geometric feature, and provides an empirical distribution of the form error, allowing engineers to quantify the decision risk on part acceptance. Unlike previously proposed GP models, this new modeling approach does not require one coordinate to be expressed as an explicit function of the other coordinates.

2 - Determining the Number of Operational Modes in Baseline Multivariate SPC Data
Hang Zhang, Postdoctoral Research Associate, Bioengineering, Arizona State University, Tempe, AZ, 85281, United States of America, hzhang12@asu.edu, Susan Albin

Manufacturing process may operate under multiple modes due to uncontrollable changes in raw materials or environment. We propose a method to determine the number of operational modes first by identifying the cluster number in baseline. Then SPC model for each mode is built to achieve better performance of online monitoring.

3 - Optimal Specifications for Degrading Characteristics
Roshan Vengazhiyil, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu, I-Tang Yu

In this article, we show that the manufacturing target for a product characteristic affected by degradation is not the value that maximizes the quality of the product. By sacrificing some quality at the manufacturing stage it is possible to increase the product's lifetime and thus reduce the quality loss over a long period. We propose a procedure for finding the optimal manufacturing target that maximizes both quality and reliability of the product.

■ MA07

C-Room 24B, Upper Level

Reliability and Statistics Related to Nanotechnology

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Tao Yuan, Assistant Professor, Ohio University, 270 Stocker Center, Athens, OH, 45701, United States of America, yuan@ohio.edu

1 - Uncertainty Modeling and Model Validation for A Nanoparticle Synthesis Process
Jye-Chyi Lu, Professor, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, 30332-0205, United States of America, jclu@isye.gatech.edu, Hin Kyeol Woo, Justin Vastola, Martha Grover

The current disconnect between the fields of robust design in statistics and mechanistic modeling in engineering will be bridged by the proposed methodology. Stochastic components linking within- and between-batch variations are added into engineering mechanistic models. Statistical models are built for reducing the complexity of the engineering-stochastic models. A methodology of validating the statistical models is developed. The example study focuses on the synthesis of metal nanoparticles.

2 - Implicit Derivative Based Yield Model Considering Nano-Device Process Variations
Tongdan Jin, Texas A&M International University, 5201 University Blvd, Laredo, TX, 78041, United States of America, tjin@tamiu.edu

A mixed-signal device can be modeled as a multi-layer architecture where top-level performance variables are controlled by the process variables at the bottom layer. An implicit derivative based decomposition model is proposed to determine the variance of performance variables based on the mean and the variance at the process level. Compared with simulations or min-max methods, our model reduces the computational time, yet without compromising the estimation accuracy.

3 - Reliability Modeling of Ge/High-k Based MOS Devices
Wilkistar Otieno, Doctoral Candidate, University of South Florida, 4202 E. Fowler Ave, ENB 118, Tampa, fl, 33620, United States of America, wotieno@mail.usf.edu, Geoffrey Okogbaa

Today, attention is shifting from Si/SiO2 to Ge/high-k based MOS technology. The lower effective mass and higher mobility of carriers in Ge compared with Si and the ultra thin stable nanofilms that is attainable when SiO2 is replaced with high-k dielectric material have prompted renewed interest in Ge-based devices. This research will utilize accelerated degradation testing schemes coupled with advanced statistical analysis tools to assess the reliability of Ge-based MOS devices.

4 - Nonparametric Bayesian Reliability and Burn-in Analysis of Nano-scale Memory Devices
Chia-Han Yang, University of Tennessee, 430 Southwest Pkwy, Apt. 1915, College Station, TX, 77840, United States of America, cyang4@utk.edu, Way Kuo, Yue Kuo, Tao Yuan

Technologies for today's design and manufacturing tend to move from the realm of micro- to nano-scale. The scaled technology raises new challenges for burn-in research. This study considers the reliability modeling and analysis of a novel nano-scale memory device. Nanocrystalline ZnO embedded Zr-doped HfO high-k memory devices are fabricated and tested. A nonparametric Bayesian approach based on the stochastic jumping process is used to study the reliability and optimal burn-in of the devices.

5 - Reliability Study for Nano-Scale Gate Dielectrics Considering Film Thickness Fluctuations
Tao Yuan, Assistant Professor, Ohio University, 270 Stocker Center, Athens, OH, 45701, United States of America, yuan@ohio.edu, Xiaoyan Zhu

Dielectric reliability is an essential factor in MOS technologies. As gate oxide approaches its scaling limit, process issues such as poor film uniformity become critical. This paper investigates both the physical and statistical aspects of gate dielectric reliability with the presence of thickness variations. A physics-based simulation model is developed to study the effects of thickness variation on dielectric reliability and a Weibull mixture model is applied to analyze the failure data.

■ MA08

C-Room 24C, Upper Level

Tutorial - Applied Predictive Modelling

Sponsor: Data Mining
Sponsored Session

Chair: Rong Duan, Principle Member of Tech Staff, AT&T, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com

1 - Applied Predictive Modelling
Rong Duan, Principle Member of Tech Staff, AT&T, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com, Tom Au

Predictive modeling has been well studied in research area. But how to utilize these models is still a challenge in the real world applications. In this tutorial, we try to give the whole picture view of what are really involved in the real world predictive modeling work.Start from data collection, data exploration to modeling and model evaluation, in each step, we introduce the possible problems and the solutions. In the case studies, we highlight the problem enchanted and the implementation.

■ MA09

C-Room 25A, Upper Level

Strong Asymptotic Optimality Results in Heavy-traffic

Sponsor: Applied Probability
Sponsored Session

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

Co-Chair: Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu

1 - On Optimality Gaps of Asymptotically Optimal Policies in the Many-server Heavy-traffic Regime
Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu, Baris Ata

The optimality gaps in many-server asymptotic optimality results are of the order of the square-root of the demand rate. Our work is concerned with improving these gaps. First, we identify cases under which the emerging asymptotically optimal controls actually induce smaller optimality gaps. For others, we discuss how to modify the limiting diffusion control problem so as to improve on the optimality gap. The results underscore the usefulness of asymptotic analysis for call center applications.

2 - Optimal Call Center Staffing and Routing with Arrival Uncertainty
Achal Bassamboo, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, 60208, a-bassamboo@kellogg.northwestern.edu, Ramandeep Randhawa

We study the capacity sizing and routing problem in a call center faced with an uncertain arrival rate. In a large system setting, we first characterize the solution to the first order fluid problem. We show that the fluid prescription coupled with a quasi-partitioning policy can have an Order-1 optimality property. That is, its optimality gap does not increase with system size.

3 - Dynamic Pricing and Scheduling in a Multi-Class Single-Server Queueing System
Eren Cil, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, e-cil@kellogg.northwestern.edu, Fikri Karaesmen, Lerzan Ormeci

We investigate a sequencing and dynamic pricing problem for a two-class queueing system. Using a MDP based model, we obtain structural characterizations of optimal policies. In particular, we show that the optimal pricing policy depends on the entire queue length vector but some monotonicity results prevail as the composition of this vector changes. On the other hand, our numerical study shows that simple dynamic pricing policies perform well in general.

4 - Refining Square Root Staffing for the Erlang A Model
Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, bozhang@gatech.edu, Johan van Leeuwaarden, Bert Zwart

We consider a useful model of call centers, namely the Erlang A model. We obtain corrected diffusion approximations for main performance measures, and apply them to several constraint satisfaction staffing problems. The proposed refined square root staffing (SRS) rule almost always yields the right staffing level, and is as simple as the conventional SRS. It enables an analytical assessment of the accuracy of the conventional SRS, and allows us to provide practical recommendations.

■ MA10

C-Room 25B, Upper Level

Asymptotic Analysis of Many-Server Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Kavita Ramanan, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States of America, kramanan@math.cmu.edu

1 - Functional Central Limit Theorem for Many Servers Queues
Haya Kaspi, Professor, Technion, Faculty of Industrial Engineering, and Management, Haifa, 32000, Israel, iehaya@tx.technion.ac.il

We consider a G/G/N queueing systems as N becomes large. The Markovian dynamics of the system is presented in terms of a process that describes the total number of customers in the system, as well as a measure valued process that keeps track of the "ages" of the various customers in service. The lecture focuses on a CLT (Diffusion Approximations) of the above pair. The limit is characterized as the unique weak solution of a certain stochastic PDE. Joint work with Kavita Ramanan.

2 - Customer Abandonment in Many-Server Queues
Shuangchi He, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, heshuangchi@gatech.edu, Jim Dai

We study G/G/n+GI queues where patience times are iid with a general distribution. We demonstrate an asymptotic relationship between the abandonment-count and the queue-length processes under the diffusion scaling and some conditions. The key assumption is that the sequence of diffusion-scaled queue-length processes is stochastically bounded. A comparison result is also established to verify the stochastic boundedness by studying a corresponding sequence of systems without customer abandonment.

3 - Convergence of Stationary Distributions of Many-server Queues with Reneging
Weining Kang, Assistant Professor, University of Maryland, Baltimore County, Department of Mathematics & Statistics, Baltimore, MD, 21250, United States of America, wkang@umbc.edu, Kavita Ramanan

We consider a GI/GI/N+GI model. Existence of stationary distributions of the state of such a system is established. Moreover, under the uniqueness assumption on the invariant state of the associated fluid model solution, we show that, as the number of servers goes to infinity, the sequence of stationary distributions for the fluid scaled system states converges to the unique invariant state. We also show some counterexamples when the uniqueness assumption fails to hold.

■ MA11

C-Room 25C, Upper Level

Research From The Daniel Rose Technion-Yale Initiative In Counterterror Operations Research

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Edward H Kaplan, William N and Marie A Beach Prof of Mgt Sciences, Prof of Public Health and Prof of Engineering, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, edward.kaplan@yale.edu

1 - Resource Allocation in a Tactical Arms Race
Moshe Kress, Naval Post Graduate School, Operations Research Department, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, mkress@nps.edu, Boaz Golany, Uriel Rothblum, Michal Penn

We consider an arms race between two opponents where the advantage achieved by one party is mitigated and eventually eliminated when the opposing party develops countermeasures. The problem faced by the defender is how to allocate resources among various countermeasure development projects. We demonstrate the model on a simple, yet current, counterinsurgency situation and also obtain a Nash equilibrium solution for a two-sided setting.

2 - Inference and Interdiction in a Terror Queue Model
Edward H Kaplan, William N and Marie A Beach Prof of Mgt Sciences, Prof of Public Health and Prof of Engineering, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, edward.kaplan@yale.edu

Prior research suggests that HUMINT-driven arrests of terror suspects are responsible for the decline in successful suicide bombing attacks on Israeli civilians. The present analysis presents a new queueing model relating terror threats and their detection by HUMINT agents to understand how preventive counterterror measures and HUMINT combine to interdict terror suspects. We also gauge the number of undetected terror plots in progress from the known utilization of HUMINT agents.

3 - Analysis of a Strategic Terror Organization: Attacks, Evolution, and Counterterrorism Response
Jonathan Feinstein, John G Searle Prof of Economics and Management, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, jonathan.feinstein@yale.edu, Edward H Kaplan

We model a terror organization's choice of the scale and timing of terror attacks when their goal is to maximize their strength over time. The terrorists suffer costs but (for successful attacks) derive benefits in proportion to attack sizes. Terrorists choose among small (one period to plan) and larger (two periods) attacks. We model terrorists' decisions and outcomes depending upon their initial strength, natural recruitment, and the intensity of counterterrorism.

4 - When a Bit More is Too Much: The Cascading Effect of Insurgency Actions on Popular Attitudes
Roberto Szechtman, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, rszechtm@nps.edu, Moshe Kress, Michael Atkinson

Insurgents that operate amid a civilian population need broad popular support in order to thrive. What is the effect of insurgents' actions on popular support? Why does coercion occasionally succeed in preventing antagonists from actively opposing the insurgents and sometimes lead to expanded popular discontent towards the insurgents? How can the sudden changes in popular attitudes towards insurgents observed in recent conflicts be rationalized?

■ MA12

C-Room 26A, Upper Level

Computational Studies Arising in Combinatorial and Stochastic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com

1 - An Efficient Approach for the Reliable Facility Location Problem
Tingting Cui, PhD Candidate, University of California Berkeley, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States of America, tingting@ieor.berkeley.edu, Robert Aboolian, Max Shen

In a reliable facility location problem, candidate locations are subject to unexpected disruptions and customers may be reassiged to facilities further away than their regular facilities. We present an efficient approach that employs neighborhood search and cutting plane algorithms, in order to find optimal facility locations that minimizes the sum of fixed location cost and expected transportation cost.

2 - Lifted Scheme of Stochastic Dynamic Knapsack Polytope in a Parallel Computing Environment
Zhili Zhou, zhilizhou@ou.edu, Yongpei Guan

We investigate the algorithmic and implementation issues for the effective and efficient generation of lifted valid inequalities of stochastic dynamic knapsack polytope in a parallel computing environment. The speedup, communication overhead, load balance, and effectiveness in closing the integrality gap for stochastic dynamic knapsack polytope are studied. The reasonable speedup is shown in computational experiments.

3 - Optimizing Interaction Code Parameters for Zinc Finger, DNA Recognition
Andrew Trapp, Doctoral Student, University of Pittsburgh, Pittsburgh PA, United States of America, Act25@pitt.edu, Alpay Temiz, Oleg Prokopyev, Carlos Camacho

We discuss a particular optimization problem in computational biology regarding protein-DNA interaction decoding. Specifically, we develop a mixed integer non-linear program to decode the interactions of zinc finger transcription factor

mutants, providing insights into how transcription factors identify and bind their targets with high affinity and specificity. We reformulate the initial problem to remove the nonlinearities by using variable substitutions and other modeling techniques.

■ MA13

C-Room 26B, Upper Level

Efficient Computational Approaches to Network Problems

Sponsor: Computing Society
Sponsored Session

Chair: Edwin Romeijn, Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - Integrated Mobile Single Facility Location and Inventory Planning Problems
Tom Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, Department of DSES, 110 Eighth Street, Troy, NY, 12180, United States of America, sharkt@rpi.edu, Jiaming Qiu

We consider the problem of locating and relocating a single mobile facility on a network in order to serve a dynamic set of customers over a finite horizon. The motivating applications of this problem arise in supply chain management and military logistics. We examine this problem under various restrictions on the entities allowed to carry inventory and various objectives, providing efficient algorithms to solve it and construct the efficient frontier for classes with multiple objectives.

2 - Fastest-Path Finding in Direction-Dependent Evolving Media
Irina Dolinskaya, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60208, United States of America, dolira@umich.edu, Robert Smith

Real-time determination of an optimal path in an evolving medium requires explicit incorporation of the cost function's time and space dependency into the model. In our work, we integrate vehicle controllers (such as engine speed) into the decision space of the algorithm and employ optimality properties to develop an efficient path-finding model. Optimal vessel routing within a dynamic sea is used throughout the presentation to motivate this work.

3 - Decomposition Algorithms for Maximizing the Lifetime of Wireless Sensor Networks with Mobile Sinks
Behnam Behdani, University of Florida, 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States of America, behdani@ufl.edu, Cole Smith

We address the problem of maximizing the lifetime of a wireless sensor network with energy-constrained sensors and a mobile sink. The sink travels along discrete locations to gather information from all the sensors. We propose several formulations, and develop a suite of decomposition schemes to solve these problems. Several properties of the sub-problem and master problem are exploited to improve the algorithm. Computational results demonstrate the efficiency of the proposed algorithms.

■ MA14

C-Room 27A, Upper Level

Software for OR/MS II

Sponsor: Computing Society
Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, john@hooker.tepper.cmu.edu

1 - Recent Developments for SIMPL: An Integrated Optimizer
John Hooker, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, john@hooker.tepper.cmu.edu, Tallys Yunes, Ionut Aron

SIMPL is a prototype modeling system and optimizer that integrates mathematical programming, constraint programming, and global optimization in a principled way. It duplicates or surpasses the performance of hand-coded integrated methods with the convenience of a general-purpose solver. We report results on planning, configuration, scheduling, and global optimization problems. SIMPL outperforms commercial MILP and CP software on most instances, sometimes by several orders of magnitude.

2 - The Comet Hybrid Optimization System
Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

This talks presents an overview of the Comet Hybrid Optimization System, its constraint programming and local search solvers and their hybridization with mathematical programming. Its application in vehicle routing, scheduling, sequencing, and timetabling.

3 - Vanguard System - Software for Enterprise Modeling and Simulation
Brian Lewis, VP Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

Vanguard System helps you bring your best OR/MS techniques out of the lab and into the enterprise. Analytics — Monte Carlo Simulation, Forecasting, Optimization, Decision Tree Analysis. Collaboration — Let multiple people contribute to a model at the same time. Web-based — Deliver interactive Web-based applications. Grid Computing — Run Monte Carlo simulations 250 times faster than spreadsheets. Stochastic Optimization — Solve virtually any optimization problem, even problems with uncertainty and non-linear, discontinuous objectives and constraints.

4 - Python Programming Language as a Simulation and Optimization Model Development Platform
Suleyman Karabuk, University of Oklahoma, 202 West Boyd, Norman, OK, 73019, United States of America, karabuk@ou.edu

Python, a general purpose programming language, with its high level native data structures and a wide variety of libraries enables developing integrated simulation/optimization models in the same programming environment at a level of abstraction comparable to using domain specific languages for both modeling tasks at the same time. We illustrate such a development cycle for addressing a transportation problem.

■ MA15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - SAS Education Division - Introduction to ODS Statistical Graphics in SAS 9.2
Tom Bohannon, Higher Education Consultant, SAS Global Academic Program, SAS Campus Drive, Cary, NC, 27513, United States of America, tom.bohannon@sas.com

This paper presents the essential information you need to get started with ODS Graphics in SAS 9.2. ODS Graphics is an extension of ODS (the Output Delivery System), which manages procedure output and lets you display it in a variety of destinations, such as HTML and RTF. Consequently, many familiar features of ODS for tabular output apply equally to graphs. For statistical procedures that support ODS Graphics, you invoke this functionality with the statement ODS GRAPHICS ON. Graphs and tables created by these procedures are then integrated in your ODS output destination. ODS Graphics produces graphs in standard image file formats, and the consistent appearance and individual layout of these graphs are controlled by ODS styles and templates, respectively.

2 - JMP Division - SAS Institute - Dynamic Visualization of Complex Data with JMP
Melodie Rush, JMP Division-SAS, 100 SAS Campus Drive, Cary, NC, 27513, melodie.rush@jmp.com, Mia Stephens

JMP is state-of-the-art data analysis and visualization software from SAS Institute. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. JMP contains a complete array of analytical procedures and always provides dynamic, visual representations alongside their statistical output. This demo will cover an overview of JMP and analysis designed for data visualization including Graph BuilderÆ, Bubble Plots, 3D Scatter Plots and the data filter.

■ MA16

C-Room 28A, Upper Level

Information Technology Impacts

Sponsor: Information Systems
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, N231 BCC, East Lansing, MI, 48824, United States of America, sambamurthy@bus.msu.edu

1 - Environmental Uncertainty and IT Infrastructure Governance: A Curvilinear Relationship

Gautam Ray, University of Minnesota, Dept of IDSC, Minneapolis, United States of America, rayxx153@umn.edu, Ling Xue, Bin Gu

Extant research considers IT governance to be a trade-off between cost-efficiency of centralization and responsiveness provided by local information processing, and predicts decentralization in more uncertain environments. We propose that the relationship between uncertainty and decentralization is a curvilinear relationship i.e., when uncertainty increases from low to high, firms decentralize decisions to the business units, and then centralize decisions as uncertainty increases further.

2 - The Impact of IT-related Spillovers on Long-Run Productivity: An Empirical Analysis

Vijay Gurbaxani, Professor, University of California, Center for Research on IT and Orgs, The Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, VGurbaxa@uci.edu, Young Bong Chang

This paper examines the effects of IT-related spillovers on firm-level productivity improvements over a long-term horizon. We focus on spillovers from inter-industry transactions, especially the IT services industry. We find that spillover impacts are significant but that the magnitude and persistence of the impacts vary with the intensity of IT investment.

3 - Co-diffusion of Wireless Voice and Data Services: The Case of the Japanese Market

Marius Niculescu, Assistant Professor of IT Management, Georgia Institute of Technology, College of Management, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, marius.niculescu@mgt.gatech.edu, Seungjin Whang

This paper explores the parallel market evolution of wireless voice and data services. These services exhibit a stand-alone/add-on relationship. Unlike voice services, data services rapidly evolved over time due to recent advances in interface and data transmission speed and security, and the increase in the content and services ported to the mobile internet space. We also allow for different corresponding consumer learning curves. We empirically test our models on the Japanese wireless market.

■ MA17

C-Room 28B, Upper Level

Information Systems I

Contributed Session

Chair: Sunil Mithas, Assistant Professor, University of Maryland, 4324 VMH U of Maryland, College Park, United States of America, smithas@rhsmith.umd.edu

1 - Customer Satisfaction with Cellphone Services: A Cross-country Analysis

Prasanto Roy, Cybermedia, Cyber House, B35 Sector 32, Gurgaon, 122001, India, pkr@cybermedia.co.in, Sunil Mithas

This study examines customer satisfaction with cellphone services across several countries in several South Asian countries. We study the effect of sales, network availability, value added services, customer care and billing on overall customer satisfaction to determine how these factors affect overall customer satisfaction across countries.

2 - The Analysis of the Software Architecture Using Metrics

Michelle Xiang Liu, Assistant Professor, Marymount University, 2807 North Glebe Road, Arlington, VA, 22207, United States of America, xiangl2001@gmail.com

This study explores a set of metrics to evaluate design architectures of software systems. Design Structure Matrices and networks-based diagrams are adopted to analyze and compare the structure of the Eclipse platform. An empirical study using proposed metrics is elaborated.

3 - Green IT Awareness and Implementation in an Emerging Economy

Sunil Mithas, Assistant Professor, University of Maryland, 4324 VMH U of Maryland, College Park, United States of America, smithas@rhsmith.umd.edu, Prasanto Roy

This study investigates the awareness and implementation of green IT movement in India, a major producer of IT services for the world markets. Based on a survey of more than 200 organizations, we find that cost is a key motivation as well as a hindrance for green IT implementation.

■ MA18

C-Room 28C, Upper Level

Optimization in Practice I - Algorithms

Sponsor: Computing Society
Sponsored Session

Chair: Ernest Forman, Dr., Department of Decision Science, School of Business, George Washington University, Washington, DC, 20052, United States of America, forman@gwu.edu

Co-Chair: Robert Vanderbei, Professor, Princeton University, Sherrerd Hall, Room 106, Princeton, NJ, 08544, United States of America, rvdb@princeton.EDU

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

1 - Solving Practical Problems with Hybrid Optimization Approaches

Genetha Gray, gagray@sandia.gov, Katie Fowler, Joshua Griffin

In this talk, we will review the EAGLS (Evolutionary Algorithm Guiding Local Search) software which allows for the hybridization of one or more optimization methods. We will focus on the design characteristics of EAGLS which make it particularly applicable for solving mixed integer problems that arise in hydrological system design.

2 - Determining an Optimal Portfolio of Projects: Project Portfolio Management

Ernest Forman, Dr., Department of Decision Science, School of Business, George Washington University, Washington, DC, 20052, United States of America, forman@gwu.edu, Raj Kanungo, William Taylor

Determining an optimal portfolio of projects involves two phases: prioritizing — developing ratio scale measures of anticipated benefits with respect to an organizations hierarchy of objectives, and determining a combination of projects that maximizes the anticipated benefits subject to dependencies and resource constraints. Three types of risk must also be addressed: business risk, project risk, and portfolio risk.

3 - Combinatorial Optimization Algorithms for Fault Diagnosis in Complex Systems

Krishna Pattipati, krishna@engr.uconn.edu

In this talk, we will first discuss a unified methodology for intelligent diagnostics that judiciously combines hybrid model-based/data-driven/knowledge-based techniques that seamlessly employs quantitative models, machine learning techniques and graph-based dependency models to address real-time diagnosis, test sequencing (NP-hard optimization problems), and remaining life predictions (solution of partial differential equations) as well as the associated maintenance optimization problems.

■ MA19

C-Room 28D, Upper Level

Online Adaptive Routing

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Travis Waller, Associate Professor, The University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78712, United States of America, stw@mail.utexas.edu

1 - Optimal Information Location for Adaptive Routing

Stephen Boyles, Assistant Professor, University of Wyoming, 1000 E. University Ave., Department 3295, Laramie, WY, 82071, United States of America, sboyles@mail.utexas.edu, Travis Waller

Providing real-time travel information with ITS infrastructure is greatly beneficial to drivers, but budgetary and technical constraints limit the number of locations where such information can be provided. The problem of identifying the best locations is studied in three contexts (individual routing, uncongested routing with many drivers, and congested routing with equilibrium), along with discussion of practical issues and performance in realistic-sized networks.

2 - Closed Loop Adaptive On-line Routing under Uncertain Information Reliability in VANETs

Lili Du, Research Associate, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, IN, 47906, United States of America, ldu@purdue.edu, Srinivas Peeta, Yong Hoon Kim, Satish Ukkusuri

Online routing is a key component in decentralized Advanced Traveler Information Systems (ATIS) based on Vehicular Ad Hoc Networks (VANET). This research studies the data fusion and online routing problems under Closed-loop Adaptive Routing (CAR) rule in VANET. Uncertainty of the information reliability provided by VANET in various traffic conditions is addressed.

3 - Trajectory-Adaptive Routing in Dynamic Networks with Dependent Random Link Travel Time

Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu, He Huang

This paper studies the problem of finding the minimum expected travel time trajectory-adaptive routing policies (TARPs) in a stochastic time-dependent network where link travel times are stochastically depedent. Trajectory information is the minimum amount of information available to any traveler. Two equivalent definitions of TARP are given, and in one case Bellman's principle is valid and in the other not. A label-correcting algorithm is designed to find optimal TARPs.

■ MA20

C-Room 28E, Upper Level

Dynamic Vehicle Routing

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Justin Goodson, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, justin-goodson@uiowa.edu

1 - Scenario Tree Based Heuristics for Stochastic Inventory Routing Problems

Lars Magnus Hvattum, Postdoctoral Fellow, Norwegian University of Science and Technology, Alfred getz vei 3, Trondheim, Norway, lars.m.hvattum@iot.ntnu.no, Gilbert Laporte, Arne Lokketangen

We consider stochastic inventory routing problems where, in every period, a set of vehicles can be used to transport cargo from a central supplier to a set of customers. The demand of each customer is stochastic, and is observed after deliveries have been made. The goal is to maximize profits from the cargo delivered subject to inventory costs, transportation costs, and stock-out costs. Heuristics are designed, using scenario trees to represent the stochastics and dynamics of the system.

2 - Dynamic Load Planning for Less-Than-Truckload Carriers

Yang Zhang, School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, yzhang2@isye.gatech.edu, Alan Erera, Martin Savelsbergh

We consider the daily dynamic load planning problem faced by LTL carriers, which looks to quickly modify planned operations given actual freight conditions. We propose both integer programming based and heuristic approaches to the problem, and present computational experiments conducted on a rolling horizon and results indicating significant savings for a national carrier.

3 - Dynamic Solutions for the Multi-Vehicle Routing Problem with Stochastic Demand and Duration Limits

Justin Goodson, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, justin-goodson@uiowa.edu, Jeffrey Ohlmann, Barrett Thomas

In the multi-vehicle routing problem with stochastic demand and duration limits (VRPSD), customer demand is known only in distribution prior to arrival at customers. We model the VRPSD as a Markov decision process with an objective of maximizing demand served. We examine a heuristic and an approximate dynamic programming approach that dynamically adjust an initial routing plan as demand is observed. We compare the demand served by dynamic procedures to that served by a priori routes.

■ MA21

C-Room 30B, Upper Level

Freeway and Network Operations

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Xuesong Zhou, Assistant Professor, University of Utah, 122 South Central Campus Dr., CME 210, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Optimizing Queuing Systems with Time-dependent Demand and Service Rates: A Fluid-based Approximation

Xuesong Zhou, Assistant Professor, University of Utah, 122 South Central Campus Dr., CME 210, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Xiaoming Chen

This talk presents the use of a fluid-based approximation approach to represent general queue systems with time-dependent arrival and service rates. Compared to Monte Carlo simulation methods, the proposed computationally efficient model can be further incorporated into a mathematical programming framework to optimize service plans in many transportation queuing systems.

2 - Speed Harmonization and Peak-period Shoulder Use to Manage Urban Freeway Congestion

N. Nezamuddin, Graduate Research Assistant, University of Texas at Austin, 1 University Station 1761, ECJ 6.512, Austin, TX, 78712, United States of America, nezam@mail.utexas.edu, Travis Waller

Speed harmonization and peak-period shoulder use are emerging as advanced traffic management (ATM) strategies to manage congestion on urban freeways in the US. These ATM strategies were implemented on MoPac Expressway in Austin and the resulting operational and safety benefits were assessed.

3 - Empirical Macroscopic Evaluation of Freeway Merge-Ratios

Hillel Bar-Gera, Senior Lecturer, Ben-Gurion University, P.O. Box 653, Beer-Sheva, 84105, Israel, bargera@bgu.ac.il, Soyoung Ahn

An existing theory states that traffic congestion accumulation at merges is dictated by a fixed merge-ratio. We present effective method to estimate merge-ratios from historical traffic data, and apply it to fifteen sites in California using PEMS data. Results show that merge-ratios can be reasonably approximated by lane-ratios, although residual differences suggest that there are probably other influencing factors as well.

4 - Freeway Travel Time Prediction Based on N-Curve and Nearest Neighbor Method

Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Brenda Bustillos

The Nearest Neighbor (NN) method in conjunction with N-curves is proposed for travel times prediction of a freeway corridor. The NN method is a non-parametric method that makes fewer assumptions on the relation between current status travel time and the computed travel time. It aims to find that day in the past which is most similar to the present day in some appropriate sense. Further, we tested two alternatives in terms of k-NN day dependency in a test network.

■ MA22

C-Room 30C, Upper Level

Maritime Transportation

Contributed Session

Chair: Panagiotis Angeloudis, Imperial College London, Skempton Building, London, United Kingdom, pa01@ic.ac.uk

1 - Real-time Yard Crane Deployment Systems for Seaport Container Transshipment Terminals

Matthew Petering, Assistant Professor, University of Wisconsin—Milwaukee, Industrial & Manufacturing Engrg. Department, P.O. Box 784, Milwaukee, WI, 53201, United States of America, mattpete@uwm.edu, F Brian Talbot

We develop several real-time yard crane deployment systems for seaport container terminals and evaluate their performance using a fully-integrated simulation model. The model considers the detailed movement of every container passing through a multiple-berth terminal during a several-week period. It is designed to reproduce the microscopic, stochastic, real-time environment at an actual facility. Performance is measured in terms of the long-run average quay crane rate that can be sustained.

2 - Planning and Optimizing Automated Yard Cranes on Container Terminals

Nils Kemme, University Hamburg, Von-Melle-Park 5, Hamburg, 20146, Germany, nils.kemme@uni-hamburg.de

The performance of automated stacking cranes (ASC) is dependent on strategic decisions on the crane system and the block layout. By means of a simulation study various combinations of block length, width and height are evaluated for four different ASC systems which mainly differ in the number of cranes per block and the passing ability of the cranes. The simulation model considers all crane and container movements in a real-world level of detail for a single yard block in a stochastic environment.

3 - A Construction and Improvement Heuristic for an LNG Inventory Routing Problem

Magnus Stalhane, PhD Student, Norwegian University of Science and Technology, Alfred Getz veg 3, Trondheim, Norway, stalham@iot.ntnu.no, Jorgen Glomvik Rakke

We present a construction and improvement heuristic for a large scale ship routing and inventory management problem for a producer of liquefied natural gas (LNG). The producer has one loading port, a large fleet of ships and a set of long-term contracts for delivery of LNG world wide. The heuristic creates an Annual Delivery Program with the aim of minimizing sailing costs and deviations from contractual demands, while maximizing the profit of selling surplus LNG in the spot market.

4 - Robust Fleet Sizing and Allocation in Industrial and Bulk Ocean Shipping Companies

Panagiotis Tsilingiris, Research Engineer, Det Norske Veritas S.A. Research & Innovation, 26-28 Akti Kondyli, Piraeus, 18545, Greece, Panagiotis.Tsilingiris@dnv.com, Erna S. Engebrethsen, Jose Fernando Alvarez, Nikolaos M. Kakalis

We propose a robust optimization solution to the fleet sizing and allocation problem. We factor in the inherent uncertainty and multi-period nature of the problem. Our approach assists senior managers with varying degrees of risk tolerance in deciding on the sale & purchase, charter-in/out, lay-up, and scrapping of ships as well as the allocation of the active ships to contracts and geographical markets. Preliminary results from a realistic case are presented.

5 - Assignment of Multi-load AGVs under Uncertainty

Panagiotis Angeloudis, Imperial College London, Skempton Building, London, United Kingdom, pa01@ic.ac.uk, Michael Bell

Several methods exist for the control of automated container terminals, but their effectiveness can be affected by the dynamic nature of the environment. We present an assignment method for Multi-Load AGVs that penalises uncertainty and contributes to the quick recovery of the port in the case of equipment failures. Several AGV performance indicators are defined and used in simulations, where it is found that the proposed technique outperforms well-known heuristics and alternative algorithms.

■ MA23

C-Room 30D, Upper Level

Joint Session MAS/SIM: DIME/PMESII Pt 2

Sponsor: Military Applications Society & Simulation
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Developing and Assessing Irregular Warfare Models to Support IED Interdiction and Mitigation

Susan Sanchez, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States of America, ssanchez@nps.edu, Ben Marlin, Adam Larson, Tom Lucas

This project addresses our nation's need to accurately model strategic level contemporary military operations. Specifically, the study provides a thorough qualitative analysis on the Peace Support Operations Model (PSOM) and in doing so outlines a methodology which should be incorporated into the VV&A process for complex combat models that incorporate the Political, Military, Economic, Social, Infrastructure, and Information (PMESII) aspects of irregular warfare.

2 - Towards Culturally-Informed Probative Forecasting of Plausible PMESII Effects

Ken Murray, Senior Computer Scientist, SRI International, 333 Ravenswood Avenue, Menlo Park, CA, 94025, United States of America, murray@AI.SRI.COM, John Lowrance, Janet Murdock

We are developing a decision-support tool that makes use of cultural knowledge while forecasting plausible PMESII effects of DIME COAs in support of SSTR operations. For a candidate COA, the tool applies rules that capture both direct and indirect plausible PMESII effects for entities in a model of the area of operation. Cultural features are used to describe the entities and constrain the effects rules. Forecasts of plausible effects are aggregated into a visual summary for the user.

3 - Irregular Warfare Analysis at the Tactical Level

J. Eddie Edwards, Operations Research Analyst, TRADOC Analysis Center, 1400 Martin Luther King Drive, ATTN: ATRC-WW, White Sands Missile Range, NM, 88002, United States of America, eddie.edwards1@conus.army.mil, Ed Cerer, Ken Brown, Paul Works, Stephen Black

TRAC is developing an Irregular Warfare analytic campaign plan to identify and/or develop a set of analytic capabilities to provide analysis that supports senior leader decisions centered on organizing, equipping, and employing ground forces within an IW environment. This counterinsurgency-based wargame is based on a Task-Event-Outcome (TEO) framework. This presentation discusses the methodology, limitations and constraints, data sources, and example results from a proof of principle use case.

■ MA24

C-Room 30E, Upper Level

Tactical and Operational Models of Irregular Warfare

Sponsor: Military Applications Society
Sponsored Session

Chair: Jeffrey Appleget, Senior Lecturer, Naval Postgraduate School, Operations Research Department, 1411 Cunningham Rd, GL-239, Monterey, CA, 93943, United States of America, jeffrey.appleget@us.army.mil

1 - Irregular Warfare: 3-Year Campaign Plan

Paul Works, paul.works@us.army.mil, Jeffrey (Eddie) Edwards, David Hudak, Leroy (Jack) Jackson, Thomas Cioppa

This briefing outlines the TRAC-led development of a robust Irregular Warfare (IW) Analytic Capability. It addresses the current state of IW analysis capability, describes foundational method, model, and tool (MMT) capability gap identification efforts, and outlines TRAC's plan to mitigate a wide range of those gaps. It outlines partnering agencies, planned capability delivery drops, and the full prototype IW analysis capability to be in place and in use by the end of FY12.

2 - Evaluation of Operational Level Irregular Warfare Models and Simulations

Bill Krondak, Director, Scenarios and Wargaming, U.S. Army TRADOC Analysis Center, 255 Sedgwick Avenue, Fort Leavenworth, KS, 66027-2345, United States of America, william.krondak@us.army.mil, Kerry Lenninger, David Lindow

TRADOC Analysis Center (TRAC) reviewed models, methods, and simulations for analysis of stability operations and irregular warfare. TRAC acquired two models for further evaluation, the Integrated Gaming System and the Peace Support Operations Model. This paper discusses the review that led to evaluation of these models, the implementation of specific scenarios, findings of the evaluation, and perspectives on the acquisition and integration of relevant social, cultural, and economic data.

3 - The Problem of Problem Framing in Complex Operations Models

Karen Guttieri, Assistant Professor, Naval Postgraduate School, 1441 Cunningham Road, GE-306, Monterey, CA, 93943, United States of America, guttieri@nps.edu

The Problem of Problem Framing in Complex Operations Models Internal conflicts, including insurgency, are pernicious, contagious, prevalent, and expected to become more so as financial and environmental crises displace and deprive populations. Prevention is an imperative for practical, doctrinal, and - in the event of genocide - normative reasons. Political and military decision makers, supported by operations researchers, must better understand social structures and processes that are commonly hidden from view - how societies interpret change. Models may help depict and anticipate the emergence of violent extremism and to determine governance needs for contested terrain. This paper draws upon multiple social disciplines to assess the state of the modeling art. A proactive posture for conflict management requires a conceptual shift, particularly regarding problem framing and analysis. Research on insurgency, now revitalized after a long period of neglect, still lacks for a working model of origins; practitioners and analysts are predominantly focused on situations that are already violent. Large number quantitative studies and country-level data fail to provide the granularity we need to understand social dynamics. The paper suggests a multi-level approach to addressing these gaps so we might better determine conditions upon which pivotal events trigger the political violence.

4 - Athena - Spiral 1 with Emphasis on the Economics Model

Robert G Chamberlain, Principal, Jet Propulsion Laboratory, M/S 144-210, 4800 Oak Grove Dr, Pasadena, CA, 91109, United States of America, rgc@jpl.nasa.gov, Leila Meshkat

The Athena simulation addresses long-term stability & reconstruction operations. All elements of power are considered; gaining the support of the population is essential to success. Athena contains models of politics, use of assets, conflict, civilian attitudes, demographics, information ops, intelligence, and economics. A social accounting matrix organizes the flows of value between economic sectors and a computable general equilibrium model determines economic consequences of actions taken.

■ MA25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Aircraft Maintenance Routing & Logistics

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Ram Gopalan, Temple University, 517, Alter Hall, School of Business, Philadelphia, PA, 19122, United States of America, gopalan@temple.edu

1 - The Impact of Aviation Checkpoint Queues on Security Screening Effectiveness
Adrian Lee, University of Illinois, 201 N. Goodwin Ave, Urbana, IL, 61801, United States of America, ajlee4@illinois.edu, Sheldon Jacobson

Despite recent technological advancements that improve the detection rate of threat items within an aviation security screening checkpoint, the average amount of time it takes to appropriately screen a passenger remains a concern. Queueing models for multi-level and selective security systems are presented, where optimal passenger assignment policies are obtained to maximize security and passenger throughput by effectively utilizing a set of available screening resources.

2 - Building Lines of Flight for Improved Maintenance Robustness
Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu, Marcial Lapp, Jaime Ibarra, Alex Heinold

Airlines build lines-of-flight that dictate the sequence of flights an individual aircraft will fly over the course of a day. Lines-of-flight that terminate at a maintenance facility provide greater opportunity for recovering from unexpected maintenance requirements. We present methods for modifying existing lines-of-flight to create lines with an increased probability of being able to overnight at a maintenance station if needed. We present extensions from results shown at CORS.

3 - The Aircraft Maintenance Base Location Problem
Ram Gopalan, Temple University, 517, Alter Hall, School of Business, Philadelphia, PA, 19122, United States of America, gopalan@temple.edu

In order to perform FAA-mandated maintenance checks, aircraft must be routed so as to remain overnight at a maintenance base every k days, with k usually being 3 or 4. This paper examines the complementary strategic problem of locating the minimum number of maintenance facilities in an Eulerian graph so as to enable all aircraft to fulfill the FAA requirements for periodic maintenance visits. A number of approximation algorithms for this problem will be presented.

■ MA26

C-Room 31B, Upper Level

Panel Discussion: Certification Process for OR/MS Professionals

Sponsor: CPMS, The Practice Section
Sponsored Session

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

1 - Certification Panel
Moderator: Michael McCoy, Dr., The Boeing Company, michael.s.mccoy@boeing.com

An Operations Research/Management Science Certification panel session will be conducted in which panel members will describe their vision of certification, the Credentialing process that would be used to evaluate and award certification, and the benefits of certification to the Operations Research community, Academic Institutions, Industry and Government and most importantly to the practitioners who apply for and receive the certification. This panel will also allow members to discuss issues and concerns as well as present new ideas to be considered by the Certification committee.

■ MA27

C-Room 31C, Upper Level

Supply Chain Simulation I

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States of America, son@sie.arizona.edu

1 - Sequential Monte Carlo Fidelity Selection In Dynamic-Data-Driven Adaptive Multi-Scale Simulations
Nurcin Celik, PhD Candidate, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85719, United States of America, nurcinkoyuncu@gmail.com, Young-Jun Son

In Dynamic-Data-Driven Adaptive Multi-Scale Simulations (DDDAMS), the fidelity of a complex simulation model adapts to available computational resources by incorporating dynamic data into the executing model, which then steers the measurement process. In this work, a Sequential Monte Carlo method is proposed and embedded into the simulation to enable its ideal fidelity selection. A prototype DDDAMS involving the proposed algorithm is successfully implemented for a semiconductor supply chain.

2 - Modeling of a Mass Customized Satellite Production System
Roberto Lu, Boeing, roberto.f.lu@boeing.com, Edward Shroyer, Lorrie Sivich, William Zanteson

There are products can be repaired and maintained after they were produced, such as automobiles, etc. There are products next to impossible to be repaired and maintained after they were produced and in service, such as satellites. Satellite is a customized product with high complexity. Satellite production system has unique features that emphasize on 100 percent successful deployment and functionality in space. The production volume maybe low as compared to automobiles, the level of customization, however, is not. This presentation discusses some of the modeling techniques and challenges in simulating a mass customized satellite production system.

3 - Stabilization of the Supply Chain by Using a Policy Optimization Approach
Alfonso Sarmiento, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States of America, sarmient@mail.ucf.edu, Luis Rabelo, Albert Jones

This presentation will discuss a methodology to perform stability analysis of the supply chain. Achieving stability requires the solution of a policy optimization problem. This problem relies upon a theorem that states ADE (Accumulated Deviations from Equilibrium) convergence of a state variable of the system implies asymptotic stability for that variable. A hybrid algorithm based on Particle Swarm Optimization and Powell Hill-Climbing techniques is used to find the stabilization policy.

4 - Automatic Partitioning of Large Scale Simulation in Grid Computing for Run Time Reduction
Esfandyar Mazhari, PhD Student, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States of America, emazhari@email.arizona.edu, Nurcin Celik, Young-Jun Son

We intend to reduce execution time of large-scale simulations by partitioning a monolithic model into multiple pieces and executing them in a grid computing environment. A method is proposed to minimize the simulation execution time considering internal computation in each partitioned mode and their time synchronizations. Also, we seek to find the most advantageous number of partitioned models by evaluating tradeoff between reduced computations vs. increased time synchronization requirements.

■ MA28

H-Room 500, Fifth Floor

Panel Session: Teaching Revenue Management and Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Moderator: Robert Phillips, Professor, Columbia University Business School, Uris Hall 408, 3022 Broadway, New York, NY, 10027, United States of America, rp2051@columbia.edu

1 - Teaching Pricing and Revenue Management
Panelists: J. Michael Harrison, Nicola Secomandi, Robert Shumsky, Costis Maglaras

Four professors who have been leaders in developing and teaching pricing and revenue management courses will discuss their experiences with what works and doesn't work in teaching this topic and give their thoughts on its place in the business school and management science curricula.

■ MA29

H-Room 501, Fifth Floor

Decisions Analysis and Risk Management in Energy Markets with Applications to Renewable Energy Projects

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

Chair: Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

1 - Insuring Unit Failures in Electricity Markets

Antonio J. Conejo, Professor, University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, antonio.conejo@uclm.es, Salvador Pineda, Miguel Carrion

A power producer trading in the futures market is required to supply its contracted energy even if some of its production units are unavailable. In such case, the producer must buy in the pool some of the contracted energy, which may result in a significant loss. To mitigate such loss, the producer can take out insurance against unit unavailability. Using a stochastic programming model, this presentation analyzes the convenience of signing such insurance and its impact on forward contracting.

2 - Evaluation of Power Storage Facilities with a Real Options Approach

Dogan Keles, Universität Karlsruhe, Hertzstr. 16, Karlsruhe, 76187, Germany, dogan.keles@wiwi.uni-karlsruhe.de, Wolf Fichtner, Dominik Moest

Energy utilities are facing several uncertainties in liberalised markets. In this paper these uncertainties are modelled with time-series models such as ARMA-processes. The simulated price paths are used in a stochastic model, to optimize the plant dispatch for a pump-storage or CAES-plant. Thereby the calculated real options value considers the value of flexibility. Results of the stochastic model are compared with a deterministic calculation, to point out the impact of uncertain parameters.

3 - Optimal Hedging Contract Structures for Wind Developers

Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

To secure financing, wind project developers need to sign long-term hedging contracts (with fixed electricity selling prices and quantities) with third parties to. For merchant wind plants, locking into a fixed revenue stream may forgo higher profits that could otherwise be earned through participating the spot electricity market. A stochastic optimization framework is proposed to obtain optimal contract structures for wind developers, subject to a fixed rate-of-return constraint.

■ MA30

H-Room 502, Fifth Floor

Forestry III: Fire Management

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

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Spatio-Temporal Arson Clusters

Douglas Thomas, National Institute of Standards and Technology, Gaithersburg, MD, United States of America, douglas.thomas@nist.gov, David Butry

Many arson incidents are clustered in space and time, which stretches fire services thin. These clusters are highly correlated with the day-to-day activities of people, making them predictable and preventable. Understanding these event-driven incidents will allow police and fire services to take actions to prevent and prepare for clustered arson incidents. This paper characterizes these types of arson events so to reduce their impact on society.

2 - Addressing Sources of Uncertainty in Strategic Fire Planning

Matthew Thompson, U.S. Forest Service Rocky Mountain Research Station, 800 East Beckwith Ave, Missoula, MT, 59801, United States of America, mpthompson02@fs.fed.us

Strategic fire planning is subject to manifold sources of uncertainty. Beyond the unpredictability of wildfire behavior, uncertainty stems from inaccurate/missing data, poor scientific understanding of ecological response to fire, and relative prioritization of non-market resource values. This work attempts to systematically align sources of uncertainty with the most appropriate decision-support methodologies, in order to facilitate cost-effective, risk-based wildfire planning efforts.

3 - Stochastic Programming Models for Wildfire Initial Attack Planning

Julian Gallego, PhD Student, Texas A&M University, 241 Zachry, TAMU 3131, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Lewis Ntaimo

We present two stochastic programming models for initial attack: standard response model (SRM) and explicit fire growth response model (ERM). The SRM assumes a known standard response needed to contain a fire of given size, while the ERM considers fire behavior characterized as fire perimeter and burned area at discrete time intervals over the initial response period. Computational results based on one of the Texas Forest Service fire planning unit in East Texas will be presented.

4 - Generating Efficient Solutions on a Nondominated Frontier for Analysis of Wildfire Management in US

Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com, Gyana Parija, Steven Carty, Andy Kirsch, Soujanya Soni

We present a multi-criteria budget allocation model for assigning national budgets across Fire Planning Units (FPU) in the US. The model generates a set of efficient solutions for the decision maker to select a preferred alternative. We discuss challenges faced by the decision maker in choosing a set of weights due to the correlation among the objectives. We review the current approach, discuss future improvements, and present results using the national analysis data for budget year 2011.

■ MA31

H-Room 503, Fifth Floor

New Frontiers in Dynamic Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Georgia Perakis, Professor, Sloan School, MIT, 50 Memorial Drive Building E53-389, Cambridge, MA, United States of America, georgiap@MIT.EDU

1 - Towards a Data-Driven View of Customer Choice

Vivek Farias, Assistant Professor, MIT Sloan School, E53-317, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, vivekf@mit.edu, Srikanth Jagabathula, Devavrat Shah

Given the importance of understanding customer choice behavior and the risks of incorrectly modeling such behavior in applications, we visit the following fundamental problem: For a 'generic' model of customer choice and a limited amount of data on how customers actually make decisions how may one predict revenues from offering a particular assortment of choices? We present a framework to answer such questions and design a number of tractable algorithms for the same.

2 - Multi-Product Pricing under Attraction Demand Models

Philip Keller, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge MA, United States of Americapkeller@mit.edu, Retsef Levi, Georgia Perakis

We consider a multi-product pricing problem under the multinomial demand model. The problem is non-concave and hence solving it efficiently is an issue. An added difficulty to the problem arises also due to capacity constraints shared among products. We illustrate its efficient solution in theory as well as by conducting numerical experiments to contrast the proposed algorithm with other approaches. We also consider its extension to more general attraction models.

3 - Dynamic Incentives for Adoption of Renewable Energy Technology

Ruben Lobel, MIT, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge MA, United States of America, rlobel@mit.edu, Georgia Perakis

We model the adoption of renewable technology as a diffusion process with rates depending on the incentives offered to the customers (eg. rebates for buying a plug-in hybrid or a photovoltaic cell). An electricity retailer offers these rebates and profits from each customer who adopts the new technology. We design optimal dynamic incentives that the retailer should offer to stimulate the technology diffusion over time while maximizing revenues.

4 - Dynamic Pricing in an Evolving Marketplace

Yiwei Chen, Massachusetts Institute of Technology, Cambridge, United States of America, ywchen@mit.edu, Vivek Farias

We consider the generic dynamic pricing problem allowing the 'scale' of demand intensity to be modulated by an an exogenous 'market size' stochastic process. This is a natural model of dynamically changing market conditions. We show that for a broad family of market size processes (namely, diffusions analogous to 'moving average' processes), simple dynamic pricing rules that are *agnostic* to the statistics of this market size process perform provably well.

■ MA32

H-Room 504, Fifth Level

Advanced Portfolio Theory and Practice

Cluster: Financial Engineering
Invited Session

Chair: John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

1 - Portfolio Theory versus Financial Engineering and Their Roles in Financial Crises
Harry Markowitz, Harry Markowitz Company, 1010 Turquoise Street, Ste. 245, San Diego, CA, 92109, United States of America, harryhmm@aol.com

Both mean-variance analysis (also known as MPT) and financial engineering which develops products and procedures based on the Black-Scholes equation and its generalizations, use mathematical techniques to advise (individual or institutional) investors. However, their effects have been quite different on the stability of the stock market and the safety of their followers.

2 - Value-at-Risk vs. Conditional Value-at-Risk in Risk Management and Optimization
Stan Uryasev, University of Florida, Department of Industrial and Systems Engineer, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, uryasev@ufl.edu

From the mathematical perspective, risk management is a procedure for shaping a risk distribution. Two popular risk measures are Value at-Risk (VaR) and Conditional Value-at-Risk (CVaR). This paper presents our personal experience working with these key percentile risk measures. We explain strong and weak features of these risk measures. We discuss related case studies conducted with the Portfolio Safeguard package.

3 - Managing a Fixed-income Portfolio
Roger Wets, Professor, University of California, Davis, EpiRisk Research, CA, United States of America, rjbwets@epirisk.com

As stressed by Markowitz in the early 1950s and many others since, investors can't ignore risk. This has led to widely implemented mean-variance models. This lecture describes an alternative approach relying on i) a more comprehensive description of uncertainty that takes into account historical and market (term structures) information and, ii) on an approximate assessment of the manager's risk aversion whose parameters can be (easily)adjusted based on the(projected) distribution of returns.

■ MA33

H-Room 505, Fifth Floor

Operations and Finance Interface

Cluster: Economic Models in Operations Management
Invited Session

Chair: Lingxiu Dong, Washington University in St. Louis, Olin Business School, 1 Brookings Drive, St. Louis, MO, 63130-4899, United States of America, dong@wustl.edu

Co-Chair: Jiri Chod, Boston College, Carroll School of Mgmt, Fulton Hall 452B, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, chodj@bc.edu

1 - Optimization of Inventory and Dividends with Risky Debt
Danko Turcic, Assistant Professor of Operations and Manufacturing Management, Washington University in St. Louis, Olin Business School, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu, Qiaohai Hu, Matthew J. Sobel

We analyze a dynamic stochastic model of a firm that coordinates operational and financial decisions and is partially financed with short-term and long-term debt. We also analyze a similar firm, which decentralizes its decisions. Assuming that bankruptcy triggers liquidation of the firm, we show that the coordinated firm has higher inventories, larger short-term and long-term debts, and issues greater dividends than the decentralized firm.

2 - Signaling Manufacturer's Private Information through Operational Decisions and Trade Credit
Pierre-Yves Brunet, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, brunetp@umich.edu, Volodymyr Babich

We consider a signaling game among manufacturers, suppliers, and banks in which manufacturers can signal their knowledge of demand distribution by their operational decisions and financing choices. We describe separating and pooling equilibria and study the role of trade credit as a signaling tool and its interactions with operational decisions. Interestingly, the total order quantity could be higher in the economy without trade credit.

3 - The Newsvendor Problem and Price-only Contract When Bankruptcy Costs Exist
Panos Kouvelis, Olin Business School, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, kouvelis@wustl.edu, Wenhui Zhao

We study a supply chain of a supplier and a capital constrained retailer with the accessibility to a break-even bank loan. Failure of loan repayment leads to a costly bankruptcy. We identify the retailer's optimal order quantity as a function of the wholesale price and his total wealth (working capital & collateral). The analysis of the supplier's problem as a Stackelberg game leads to unique solutions in wholesale price and order quantity smaller than the traditional newsvendor order quantity.

4 - Operational Flexibility and Financial Leverage
Jiri Chod, Boston College, Carroll School of Mgmt, Fulton Hall 452B, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, chodj@bc.edu, Jianer Zhou

We consider a two-product financially-constrained firm that has to choose the optimal mix of flexible and dedicated capacities as well as the optimal level of external financing while facing demand uncertainty. We study the relationship between the firm's mix flexibility and financial leverage, and how it is impacted by the bankruptcy cost and agency conflict between shareholders and bondholders.

■ MA34

H-Room 520, Fifth Floor

Research Issues for OEM Remanufacturing

Cluster: Green Supply Chain
Invited Session

Chair: Daniel Guide, Associate Professor, Penn State University, 464 Business Building, University Park, PA, 16802, United States of America, dguide@psu.edu

1 - Research Issues for OEM Remanufacturing
Daniel Guide, Associate Professor, Penn State University, 464 Business Building, University Park, PA, 16802, United States of America, dguide@psu.edu, Luk Van Wassenhove

We present an overview of key research issues for OEMs that engage in remanufacturing and/or product recovery. Our discussions are based on a recent round table and projects with several OEMs.

■ MA35

H-Sapphire A, Fourth Floor

Healthcare Management - Planning II

Sponsor: Health Applications
Sponsored Session

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

1 - Bayesian Analysis of Discrete Time Queues with a Healthcare Application
Toros Caglar, The George Washington University, 2201 G Street NW, Funger 415, School of Business, Washington, DC, 20052, United States of America, toros@gwu.edu, Refik Soyer

Discrete time queues have mostly been analyzed in the context of computer and communication systems. In this study, we aim to utilize a Bayesian approach for the analysis of discrete time queues in a healthcare management setting. We focus on the Geo/Geo/1 queue, and obtain posterior distributions of the system parameters and performance measures using conjugate priors. With this framework, we also provide a numerical example using emergency department arrival and service data.

2 - Integration of Simulation Modeling into Hospital Pharmacy Delivery Network Planning
Beilei Zhang, University of Missouri, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, bztdd@mizzou.edu, Kalyan Pasupathy

This project aims at optimizing internal pharmacy supply chain network by using a hybrid modeling approach combining simulation and mathematical modeling, such that supply chain "5Rs" can be integrated and quantified. The simulation modeling is used to build stochastic scenarios and conduct performance report, while the mathematical model defines networking strategies for each scenario. By comparing different performance reports, the most suitable networking strategy can be identified.

3 - Dynamic Performance Evaluation System for Patient Controlled Analgesia Program

Jy Yu, NTU, Department BA, 9F, Management Building 1, 1, Sec. 4, Roosevelt Road, Taipei, 106, Taiwan - ROC, jyyu@ntu.edu.tw, Jo-Lin Tsao

The Department of Anesthesiology at a leading national hospital is planning to renovate its currently under-productive patient controlled analgesia program (PCA) for patients after surgical operations. In this study, a performance evaluation scheme for PCA is proposed base on Balance Scorecard (BSC). To take account of the interweaving causalities embedded in practice, an integrated dynamic BSC is developed with System Dynamics, based on which the key performance indicators are identified.

■ MA36

H-Sapphire B, Fourth Floor

Quantitative Analysis of Medical Signal Data

Sponsor: Health Applications
Sponsored Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

1 - A New Approach for the Identification of Cardiac Disorders

Hui Yang, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, huiyang@eng.usf.edu, Satish Bukkapatnam

Cardiovascular diseases are the leading causes of mortality in the world. This paper presents a novel spatial octant-wise analysis of vectorcardiogram (VCG) loops for the identification of various types of myocardial infarction (MI). This study reveals that significant spatial distribution differences exist between MI and healthy control (HC) groups and octant features can distinguish MIs from HCs with a sensitivity of 97.28% and a specificity of 95.00%.

2 - Diagnosis of Wegener's Granulomatosis Using Predictive Modeling Techniques

Vladimir Boginski, University of Florida, REEF, 1350 N Poquito Road, Shalimar, FL, 32579, United States of America, boginski@reef.ufl.edu

Optimization-based data mining techniques were utilized for the analysis of the Wegener's granulomatosis patient dataset, and accurate diagnosis outcomes were obtained using the constructed mathematical models. Specifically, using the Smooth Support Vector Machine (SSVM) models, we were able to achieve high prediction accuracy on the considered patient dataset.

3 - Reinforcement Learning Framework for Seizure Prediction

W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu, Shouyi Wang, Stephen Wong

In this talk, we present a new paradigm of seizure prediction based on quantitative analyses of brainwave recordings (i.e., electroencephalograms) that employs advances in reinforcement learning, pattern recognition and time series analysis. The results suggest that the new paradigm is promising and can be applied to other event prediction problems.

■ MA37

H-Sapphire C, Fourth Floor

Health Care Value Chain Optimization

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Stefanos Zenios, Professor, Stanford University, 518 Memorial Way, Stanford, United States of America, stefzen@stanford.edu

1 - Post-Marketing Drug Surveillance

Margrét Bjarnadottir, Assistant Professor of Operations, Information and Technology, Graduate School of Business, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States of America, margret@stanford.edu, Stefanos Zenios

After the withdrawal of Vioxx from the pharmaceutical market in 2004, post-FDA-approval drug safety and surveillance has come under serious scrutiny. We build a mathematical framework for a real-time drug surveillance system based on the use of claims-data. We report both some analytical and empirical results. Our work shows that a successful drug-surveillance system can be built, based on claims data analysis and could become one of FDA's standard tools for post-marketing surveillance.

2 - Performance Contracting for Outpatient Medical Services

Sergei Savin, The Wharton School, 3720 Walnut Street, Philadelphia, PA, 19104, United States of America, svs30@columbia.edu, Houyuan Jiang, Zhan Pang

Both mean-variance analysis (also known as MPT) and financial engineering which develops products and procedures based on the Black-Scholes equation and its generalizations, use mathematical techniques to advise (individual or institutional) investors. However, their effects have been quite different on the stability of the stock market and the safety of their followers.

3 - Pharmaceutical Promotion with Leakage under a Pharmaceutical Price-volume Agreement

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

Formularies may list drugs that have been approved regulatory authorities. However, once a drug is approved there can be "leakage" to unapproved or "off-label" indications. Some third-party payers use price-volume agreements to control unspecified drug uses. We take a game theory perspective to investigate the impact of price volume agreements on promotional effort and leakage.

4 - Capacity Planning and Process Configuration in Radiation Therapy

Vincent Chow, BC Cancer Agency, 600 West 10th Avenue, Vancouver, Canada, vchow@bccancer.bc.ca, Martin Puterman, Pablo Santibanez

We present a model of Radiation Therapy treatment to understand the relationships between patient access, process configuration and capacity decisions. We consider scenarios such as changes in patient mix, treatment techniques (clinical practice) and resource availability. We measure performance in terms of access (patient wait times) and efficiency (resource utilization). In this presentation we show applications of this model within the Radiation Therapy program at the BC Cancer Agency.

■ MA38

H-Sapphire D, Fourth Floor

Fighting Supply Uncertainty: Guaranteeing, Dual Sourcing, Emergency Ordering and Transshipping

Cluster: Inventory Management
Invited Session

Chair: Metin Cakanyildirim, University of Texas at Dallas, UTD School of Management, SM30, Richardson, TX, 75083-0688, United States of America, metin@utdallas.edu

1 - The Role of Supply Guarantees in the Face of Capacity Uncertainty

Haresh Gurnani, Professor, University of Miami, 5250 University Drive, Coral Gables, FL, 33146, United States of America, hgurnani@exchange.sba.miami.edu, Saibal Ray, Mehmet Gumus

In this work, we model a supply chain that consists of a buyer and two suppliers. First supplier has unlimited capacity, whereas the second one has capacity uncertainty. Buyer needs to allocate a fixed amount to these suppliers and will use spot market if total production is less than what is ordered. In this context, we examine the role of supply guarantees in symmetric and asymmetric information cases.

2 - An RFID-enabled Emergency Ordering Policy

Gary Gaukler, TAMU, TAMU-3131, College Station, TX, United States of America, gaukler@tamu.edu

In this research, we attempt to model the value of supply chain visibility in improving inventory control policies. We consider a global supply chain with stochastic resupply lead times and order progress information provided by RFID checkpoints. We derive a new policy for emergency ordering based on supply chain visibility and evaluate the impact on supply chain cost.

3 - Transshipment Prices

Metin Cakanyildirim, University of Texas at Dallas, Dallas, TX, metin@utdallas.edu, Nagihan Comez, Kathryn Stecke

A common method of inventory sharing among independent retailers is retailer-to-retailer trade, called transshipment. When a unit of inventory is shipped from a retailer to another retailer, the receiving retailer pays a transshipment price to the sending retailer. We examine how these prices are determined and also how they can be determined with a dynamic inventory model.

■ MA39

H-Sapphire E, Fourth Floor

Managing Product Rollovers

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Svenja Sommer, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Paris, France, sommers@hec.fr

1 - Modeling Aircraft Upgrades in a Closed Loop Supply Chain
Ananth Iyer, Purdue University, aiyer@purdue.edu, Asima Mishra, Vinayak Deshpande

We present an aircraft rolling upgrade problem context at the US Coast Guard. An associated model of the upgarde process consists of two closed loop supply chains, representing components and aircrafts. Analysis of the model shows how the mix of product types can be adjusted to compensate for component availability constraints. Data from the US Coast Guard are used to suggest the impact of such flexible use of product configurations in the system.

2 - Sequential Innovation under Development Uncertainty: Inventory and New Product Launch Decisions
Sreekumar Bhaskaran, Asst. Professor, SMU-Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@cox.smu.edu, Ankur Goel, Karthik Ramachandran

We look at the inventory planning and introduction timing decisions surrounding product rollovers in sequential innovation when a firm faces uncertainty regarding the outcome of a new product development endeavor. We characterize the product launch timing decision as the optimal recourse to observed new product quality and current product inventory. Effect of emergency option and competition are also analysed.

3 - Time to Market for Closed Loop Supply Chains
Andreas Robotis, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Jouy en Josas, 78351, France, robotis@hec.fr

In the last decade, environmental awareness in Europe has skyrocketed. Green, closed loop supply chains have become a political and business priority. However, closed loop supply chains impose additional restrictions on product design and manufacturing, which might imply longer time to market in new product development. Using industry data we examine the difference in the time to market for companies that operate closed loop supply chains in comparison with those that operate open loop ones.

4 - Product Rollover Decisions During Regulatory Changes
Svenja Sommer, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Paris, France, sommers@hec.fr, Mohammad Saoud, Ananth Iyer

New environmental regulations are imposing increasingly strict standards on manufacturers, requiring them to redesign products and cease producing older versions by a specific date. We consider the technology choice made by the manufacturer during redesign and its effect on product availability of both product versions to the distribution channel. Among others, we explore how the product architecture and competition affects the technology choice of manufacturers facing such regulatory changes.

■ MA40

H-Sapphire H, Fourth Floor

Financial Optimization and Applications

Sponsor: Financial Services
Sponsored Session

Chair: Kumar Muthuraman, University Of Texas, B6500, 1 University Sta, 78712, United States of America, kumar@mail.utexas.edu

1 - The Effect of Managerial Ability and Commitment on Mutual Fund Allocations
Stathis Tompaidis, Associate Professor, University of Texas at Austin, McCombs School of Business, IROM Department, Austin, TX, 78712, United States of America, Stathis.Tompaidis@mccombs.utexas.edu, Ti Zhou, Ron Kaniel

In a model where mutual fund managers have the ability to generate excess returns we contrast the fund allocations chosen by a manager that invests her personal wealth in a private account to that of a manager that is either forced to commit her wealth to the fund or a manager who is not allowed to hold risky assets held by the fund privately. We show that a fund managed by a manager with higher ability does not necessarily achieve higher expected returns but achieves lower return volatility.

2 - Hydro Scheduling Powered by Derivatives
Jussi Keppo, University of Michigan, 1205 Beal Avenue, Ann Arbor, United States of America, keppo@umich.edu, Stein-Erik Fleten

Using data from thirteen Norwegian hydropower plants, we find that electricity derivative prices affect significantly the scheduling decisions. Hence, consistent with recommendations by several theoretical Operations Management studies, financial market information is used in the everyday production planning practice. Further, since our empirical model explains about 88% of the realized variation in the power plant scheduling, the model can be used to simplify the scheduling in practice.

3 - Equity Default Swaps under the Jump to Default Extended Constant Elasticity of Variance (JDCEV)
Rafael Mendoza-Arriaga, Assitant Professor, The University of Texas at Austin, Information, Risk, & Operations Manageme, CBA 5.202, B6500. 1 University Station, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu, Vadim Linetsky

An Equity Default Swap (EDS) provides protection in case of default and in case of a large drop in the stock price of the reference firm. The credit event of an EDS is better defined and provides higher spreads than a CDS. We price the EDS as a contingent claim written on a defaultable stock using the JDCEV process, where default occurs either by diffusion or by a jump to default. We solve the first passage time problem to compute the EDS spreads and compare them to the equivalent CDS spreads.

4 - Pricing Discretely Monitored Lookback Options in Levy Process Models
Liming Feng, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@uiuc.edu, Vadim Linetsky

We present a method based on the Hilbert transform for the computation of exponential moments of the discrete extremum of a Levy process, and valuation of discrete lookback options in Levy models. When implemented in the Fourier space, our method demonstrates exponentially converging approximation errors.

■ MA41

H-Sapphire L, Fourth Floor

JFIG Research Session I

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Yasemin Merzifonluoglu, Virginia Tech, 250 Durham Hall (0118), Blackburg, VA, 24081, yasemin@vt.edu

1 - Humanitarian Logistics - An Overview I
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu

Humanitarian logistics encompasses a broad range of activities related to preparing, Humanitarian logistics encompasses a broad range of activities related to preparing, responding, and recovering from natural and man-made disasters as well as ongoing humanitarian crises due to war, famine, and infectious diseases. These activities involve the participation of non-governmental organizations (NGOs, e.g., World Food Programme, Red Cross, CARE, World Vision), governments (local, federal), industry, and the military. Disaster relief aid is typically provided on an urgent basis through governments and global aid agencies. Unfortunately the global catastrophes highlighted the difficulties organizations have in planning for and responding to the events including lack of warning systems for the Tsunami, difficulty in reaching earthquake victims because of damaged infrastructure or government policies, and poor response for Katrina victims. These events also highlighted the importance of collaboration and coordination across agencies. According to a Fritz Institute survey, during the tsunami 44% of agencies did not work with others when planning their activities, often chasing the same products. Many of these inefficiencies, which cost lives, could have been avoided with advance planning and capacity building, effective management of response activities, and collaboration and coordination across agencies. We give an overview of the characteristics of humanitarian supply chains and discuss several projects we have conducted in the area with partner organizations.

2 - Humanitarian Logistics - An Overview II
Julie Swann, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, 30332, United States of America julie.swann@isye.gatech.edu

■ MA43

H-Room 400, Fourth Floor

Pricing and Equilibria in Supply Chains

Cluster: Supply Chain Models
Invited Session

Chair: Mahesh Nagarajan, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, mahesh.nagarajan@sauder.ubc.ca

1 - Computing Pure Nash Equilibria in Games with Piecewise Linear Utilities
Christopher Ryan, PhD Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, chris.ryan@sauder.ubc.ca, Albert Xin Jiang, Maurice Queyranne, Matthias Koeppe, Kevin Leyton-Brown

We explore computing pure Nash equilibria for two classes of non-cooperative games with piecewise linear utilities. Using recent results from the algorithmic study of short rational generating functions for encoding sets of integer points, we present efficient algorithms (taking some parameters to be fixed) for deciding the existence of pure Nash equilibria in these games, and as well as other related computations.

2 - Benefits of Decentralization When Customers are Strategic
Gavin Yang, PhD Student, Sauder School of Business, UBC, Vancouver, BC, V6T 1Z2, Canada, gavin.yang@sauder.ubc.ca

We consider a dynamic two-period model of one manufacturer who sells a hi-tech product through retailers, who engage in Cournot competition. With strategic customers, we find that a decentralized channel may have higher profit than a centralized channel with dynamic wholesale price contracts. We find that in addition to the double marginalizationeffect, both downstream retailer competition and customer and firm discounting are also driving factors of the higher decentralized channel profit.

3 - Transshipments of Inventories: Dual Allocations vs. Transshipment Prices
Xiao Huang, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, xiao.huang.2009@marshall.usc.edu, Greys Sosic

We study a newsvendor game in which retailers transship leftover inventories after meeting their local demands. We compare two methods for distribution of residual profit - transshipment prices (TP) and dual allocations (DA). We study the conditions for the existence of the NE under DA, compare efficiency of TP and DA, and develop heuristics for TP when n>2. Our results suggest that the difference in profits is not significant when n=2, and that DA is preferred among more asymmetric retailers.

4 - Joint Pricing and Inventory Control: Sufficient Condition of Quasi-concavity
Zhan Zhang, PhD Student, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, zhan.zhang@sauder.ubc.ca, Hong Chen

We study a periodic-review, discounted-expected-profit maximization problem for a retailer who faces price-sensitive random demand over a finite horizon. Any unsatisfied demand is backordered. The inventory cost is convex (or quasi-convex). We show that a base stock list price (or base stock list price-type) policy is optimal for additive demand model, under mild sufficient conditions of demand distribution and quasi-concave expected revenue.

■ MA44

H-Room 402, Fourth Floor

Service Systems: Theory and Application

Sponsor: Service Science
Sponsored Session

Chair: Robin Qiu, Associate Professor, Penn State, 30 E Swedesford Road, Malvern, United States of America, robinqiu@psu.edu

Co-Chair: Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu

1 - Application of Structural Equation Models and Principal Component Analysis for Improving an Engineer
Michael Piovoso, Professor, Penn State University, 30 E Swedesford Road, Malvern, PA, 19355, United States of America, mjp5@psu.edu, Robin Qiu

Currently enrolled students were asked to complete a questionnaire to provide data to help us analyze and improve the program. The information was analyzed using Principal Component Analysis (PCA) to guide a Structural Equation Model (SEM). The results of that analysis will be presented.

2 - Semi-supervised Methodology for Accurate Categorization and Labeling of Services Engagements
Aleksandra Mojsilovic, IBM, 1195 West Fremont Avenue, Sunnyvale, CA, 94087, United States of America aleksand@us.ibm.com, Moninder Singh, Jianying Hu

Due to dynamic business environments and changing customer needs service portfolios are frequently redefined, limiting the ability to apply analytics and project management tools to track project success along the categories aligned with service portfolio. We describe a semi-supervised clustering methodology to perform new project categorization every time the solution taxonomy changes and discuss its application in a web-based decision support system.

3 - Extreme Customer Service: An Approach to Staying Competitive
Jingjing Zhou, Nanjing Golden Eagle Summit Hotel, 1 Zhujiang Road, Nanjing, JS, 210008, China, njartjingjing@yahoo.com.cn

There is a lack of practical models to help hotels transform to meet the changing needs in today's dynamic market. This talk shows our exploration of an innovative modeling methodology focusing on enabling better understanding of how hotels perform quantitatively and qualitatively. The model is able to pinpoint the challenges during daily operations and then identify optimal countermeasures and priorities in transforming the operations to remain in the outperform class as time goes.

4 - Service Composition Based on Networks and Mathematical Programming
Liying Cui, PhD Candidate, Penn State University, 121 EE East, University Park, PA, 16802, United States of America, luc5@psu.edu, Soundar Kumara, Tao Yao

Service composition is to fuse the distributed business processes together to form compound services in a timely and accurate manner. A matrix based graph analysis method is used in the web service network analysis to detect the correlations between services and parameters. Multi-criteria programming model is used to make optimal plans for queries.

■ MA45

H-Room 410, Fouth Floor

Empirical Research in New Product Development

Cluster: New Product Development
Invited Session

Chair: Kamalini Ramdas, Professor, London Business School, kramdas@london.edu

1 - Technological Spillovers and the Agglomeration of the Semiconductor Industry in Silicon Valley
Francisco Veloso, fveloso@cmu.edu, Steven Klepper, Jon Kowalski

We investigate the microfoundations of technological spillovers in clusters. When these result from information exchange or employee mobility, existing firms in clusters should move to the technological frontier faster. But when the conduit is spinoffs, firms in clusters are likely to start at the technological frontier. Using data on virtually every firm that entered the semiconductor industry and their entire set of products, we find that knowledge diffused mostly through spinoffs.

2 - Creative Problem Solving: A Tournament Approach
Karan Girotra, Assistant Professor, INSEAD, Boulevard De Constance, Fontainebleau, France, karan.girotra@insead.edu, Christian Terwiesch, Karl Ulrich

Creative problem solving often entails an iterative process of generation of multiple solutions to a problem followed by the selection and refinement of the top few. We examine the effectiveness of alternate solution generation, selection and refinement processes. We propose metrics for evaluation of each of the sub-processes and suggest strategies to improve the outcome of the Creative Problem Solving Exercise.

■ MA46

H-Room 411, Fourth Floor

Technology and Innovation

Sponsor: Technology Management
Sponsored Session

Chair: Janice Carrillo, Associate Professor, University of Florida, P.O. Box 1171769, Gainesville, FL, 32611-7169, United States of America, janice.carrillo@cba.ufl.edu

1 - The Market Value of Supply Chain Flexibility: Theory and Evidence From the Clean Energy Industry
Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu, Jane Davies

Nexus of competition is said to be shifting from individual firms to supply chains. We study flexibility, integration, assets and technology constructs that are

reflected in the stock market valuation and then calculate associated supply chain effects. We offer and test hypotheses on the synergy between these constructs in the context of 42 solar photovoltaic supply chains. Results indicate that integration and assets are significantly associated with the valuation of the supply chain.

2 - Globalization, Offshoring, and the Location of Innovation: A Case Study of Rare Earth Technology

Brian Fifarek, Engineering Supervisor, Eaton Corporation, 4201 N 27th St., Milwaukee, WI, 53216, United States of America, BrianFifarek@Eaton.com

We analyze the impact of the movement of rare earth materials production from US to China on US rare earth innovation activities. We show that this movement causes some innovation activities to move away while others remain. We suggest that this relocation of innovation is conditioned by the nature of innovation processes and the role of knowledge spillovers among value chain actors. Using patents and industry observations, we use regression and modeling techniques to test this relationship.

3 - The Emergence of Architecture in Modular Systems: Coordination Across Boundaries at ATLAS, CERN

Philipp Tuertscher, Assistant Professor, WU Vienna University of Economics and Business, Entrepreneurship and Innovation, Nordbergstrasse 15, Vienna, 1090, Austria, Philipp.Tuertscher@wu-wien.ac.at, Markus Nordberg, Raghu Garud

Our study of the development of a complex technological system suggests that the emergence of technological architecture is characterized by an ongoing process of negotiations across diverse actors who have to justify and explain their design rationales. Such a process results in what we call interlaced knowledge, making it possible for actors to generate a deeper systemic understanding of the various components, anticipate latent interdependencies and coordinate even as the design emerges.

4 - Explaining Structural Ambidexterity in High Technology Organizations: A Multilevel Perspective

Aravind Chandrasekaran, The Ohio State University, Management Sciences Department, Fisher College of Business, Columbus, OH, 43210, United States of America, chandrasekaran.24@osu.edu, Roger Schroeder, Kevin Linderman

Prior studies have emphasized the importance of structural ambidexterity. Yet, our understanding about this capability is still limited. This research delineates structural ambidexterity into two different contexts: macro and micro organizational contexts. Using multilevel data collected from 34 high technology divisions and 110 innovation and improvement projects, we examine the effects of both these contexts on project performance. Theoretical and practical Implications are discussed.

■ MA47

H-Room 412, Fourth Floor

Tutorial: Interfaces of OM and Economics

Cluster: Tutorials
Invited Session

Chair: Martin Lariviere, Kellogg School of Management, Northwestern University, Evanston, IL, 60091, United States of America, m-lariviere@northwestern.edu

1 - Interfaces of OM and Economics

Martin Lariviere, Kellogg School of Management, Northwestern University, Evanston, IL, 60091, United States of America, m-lariviere@northwestern.edu

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

■ MA48

H-Sapphire Green Room, Fourth

History of OR/MS

Contributed Session

Chair: Orhan Guvenen, Professor, Bilkent Univesirty, Ankara, Turkey, gorhan@bilkent.edu.tr

1 - Concerning the Evolution of the Jobcentric Network Schedule

Chris Smith, Adjunct Professor, University of Maryland, 4112 Everett Street, Kensington, 20895, United States of America, ltccsmith@yahoo.com

The evolution of network scheduling topologies; from the early applications of the U. S. Navy Special Projects Office, U. S. Navy Bureau of Yards and Docks, du Pont and Sperry Rand Corporations, through contemporaneous versions of the Precedence Diagramming Method, is presented. The shift to 'jobcentric' topologies in the late 1960s and 1970s is highlighted as is the recent emergence of CPM as a manipulative device employed within questionable financial recovery schemes.

2 - Transdisciplinarity in Decision Sciences: A Discourse on Polymath-Renaissance Man Methodology

Orhan Guvenen, Professor, Bilkent Univesirty, Ankara, Turkey, gorhan@bilkent.edu.tr, Murat Hakan Ozturk

In the recent century, through the developments of analytical methods in Decision Sciences, reductive subset analysis has emerged as a main challenge in the analysis of socio-economic phenomena. In this study, we are going to explore the integrated fallicies in the theory of decision sciences ranging from information distortion to rationality concept.

■ MA49

H-Room 300, Third Floor

Workforce Planning in Professional Service Organizations

Cluster: Workforce Engineering and Management
Invited Session

Chair: Jennifer Ryan, Associate Professor, Decision Sciences and Engineering Systems, RPI, 110 8th St Ctr for Industrial Innovation, Suite 5015, Troy, NY, 12180, United States of America, ryanj6@rpi.edu

1 - Modeling the Workforce Planning Process in Service Operations

Vincent Hargaden, PhD Student, UCD Michael Smurfit Graduate Business School, Centre for Doctoral Research, Blackrock, Dublin, Ireland, vincent.hargaden@ucd.ie, Jennifer Ryan

We develop a mixed integer programming model that enables professional service firms to optimise the allocation of their employees to meet customer project requirements in a dynamic operating environment. We will present results from the model based on data from a number of professional service firms of varying size to illustrate the issues facing such firms as they attempt to optimally match skilled workers to customer demand.

2 - Workforce Planning for Services with Short Lives

Ruwen Qin, Assistant Professor, Missouri S&T, Engineering Management & Systems Enginee, Rolla, MO, 65409, United States of America, qinr@mst.edu, Haiyuan Wang

We study the workforce planning for services with short lives. The average service time is long at the beginning of a service's life, and it declines progressively as served requests accumulate. This process of learning is manageable through workforce planning and is influenced by the demand distribution over the service's life. Optimal control is used in this study to minimize the total of lifecycle costs.

3 - The Effect of Department and Organizational Structure on Knowledge Transfer

Tonya Boone, Associate Professor, College of William & Mary, Operations & Information Technology, Mason School of Business, Williamsburg, VA, United States of America, Tonya.Boone@mason.wm.edu

We consider the factors associated with organizational knowledge transfer in a professional service organization with multiple departments. Earlier research has demonstrated the likelihood of asymmetric knowledge flows among departments. This talk explores the potential factors underlying the asymmetries, and develops suggestions for improving overall knowledge transfer.

■ MA50

H-Room 302, Third Floor

The Wide World of Sports

Sponsor: SpORts
Sponsored Session

Chair: Joel Oberstone, Professor, University of San Francisco, School of Business & Management, 2130 Fulton Street, San Francisco, CA, 94117, United States of America, qba.teechur@gmail.com

Co-Chair: Keith Willoughby, Associate Professor, University of Saskatchewan, Dept of Finance and Management Science, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca

1 - Searching for Momentum in the NFL

Michael Fry, Associate Professor, University of Cincinnati, 532 Lindner Hall, Cincinnati, OH, 45221, United States of America, mike.fry@uc.edu, F. Alan Shukairy

Momentum has been described as "the most important thing in football, even if I'm not sure what exactly it is" by sports writer Frank Deford. Here we seek to identify the impact of momentum in the National Football League. We examine so-called "momentum-changing" events in a football game (e.g., fourth down conversions) and statistically analyze their impact on team performance as measured by subsequent yards gained, expected points scored and other measures.

2 - Locally Optimized Crossover for the Traveling Umpire Problem
Michael Trick, Professor of Operations Research, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15232, United States of America, trick@cmu.edu, Hakan Yildiz

We present a genetic algorithm (GA) to solve the Traveling Umpire Problem, which is a recently introduced sports scheduling problem that is based on the most important features of the real Major League Baseball umpire scheduling problem. In our GA, contrary to the traditional way of randomly obtaining new solutions from parent solutions, we obtain partially optimized solutions with a locally optimized crossover operator. Improved results over other methods are presented on benchmark instances.

3 - Scheduling Games in the Canadian Football League
Keith Willoughby, Associate Professor, University of Saskatchewan, Dept of Finance and Management Science, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca, Kent Kostuk, Josh Oubadia

The 8-team Canadian Football League features an 18-game regular season played between late June and early November. Currently, the regular season schedule is manually created. We report on the development of a mathematical model to efficiently schedule games. Our model incorporates various objective functions (e.g. maximizing intra-divisional games in the season's "home stretch"), thereby providing league officials with another perspective on schedule development.

4 - English Premier League Goalkeepers: Using the Opta Index to Separate the Best From the Rest
Joel Oberstone, Professor, University of San Francisco, School of Business & Management, 2130 Fulton Street, San Francisco, CA, 94117, United States of America, qba.teechur@gmail.com

The Opta Index is a prestigious, proprietary method used to assess English Premier League (EPL) football players. The Index grades a player on a specific, weighted array of game actions. This paper proposes an alternative to using the Opta Index as the primary indication of player worth. A retrodictive linear regression model for determining the statistical significance of the game actions for the goalkeeper position is presented using Opta Index data from the 2007-2008 EPL Season.

■ MA51

H-Room 303, Third Floor

Scheduling

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

Chair: Nedialko Dimitrov, The University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, ned.dimitrov@gmail.com

1 - Sequencing of Events with Group Availability and Precedence Constraints
Ada Barlatt, Assistant Professor, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, abarlatt@uwaterloo.ca, Arleigh Waring

Motivated in part by interview scheduling, we present an algorithm that efficiently sequences events subject to availability and precedence constraints. Each event has predetermined duration and attendee requirements. Our algorithm integrates individual schedules to sequence events according to the availability of attendees. We discuss how our approach extends to other sequencing problems.

2 - Preventive Maintenance Models for a System of Stochastic and Structurally Dependent Equipments
Inderjeet Singh, The University of Texas at Austin, Operations Research / Industrial Engg., 1 University Station C2200, Austin, TX, 78712, United States of America, inderjeet@mail.utexas.edu, Elmira Popova, Ernie Kee

We optimize preventive maintenance schedule for a repairable system of multiple equipments when failure and structural dependencies exist between the equipments. The equipments of interest have increasing rate of occurrence of failures and are minimally repaired upon failure. All the equipments undergo preventive maintenance at the end of a finite planning horizon and the budget for the preventive maintenance is limited. The objective is to minimize the expected total corrective maintenance cost

3 - Hospital Patient Flow Management through Admission Scheduling and Control
Jonathan Helm, University of Michigan, 1205 Beal Ave, Ann Arbor, United States of America, jhelm@umich.edu, Mark Van Oyen

Hospital care services are frequently subject to significant and unnecessary detrimental fluctuations in inpatient census and associated workload. One of the primary controllable drivers in this census variability is the way in which patients are admitted to the hospital for an inpatient stay. This talk focuses on analysis and optimization of two levers for controlling patient flow: 1) elective admission scheduling, 2) dynamic census adjustment with the goal of reducing census variability.

■ MA52

H-Room 304, Third Floor

Pricing Strategy and Distribution Channels

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Dennis Yu, Clarkson University, School of Business, Potsdam, NY, 13699, United States of America, dyu@clarkson.edu

1 - Ordering and Pricing a Fashion Product to Minimize Regret
Scott Webster, Professor, Syracuse University, 721 University Av, Syracuse, NY, 13244, United States of America, stwebste@syr.edu, Charles Wang, Sidong Zhang

We consider the problem of ordering and pricing a fashion product. Product that remains after the season will be marked down or sold through a liquidator. The retailer is able to accurately estimate lower and upper limits on valuation. The objective is to minimize the maximum regret. We derive expressions for optimal solutions to single-product problems and we apply these results to solve multi-product problems with budget constraints.

2 - The Effect of Distribution of Free Product in a Dual Channel
John Zhijiang Ni, Ph.D Candidate, Kelley School of Business, Indiana University, 1309 East 10th Street, Bloomington, IN, 47401, United States of America, jzni@indiana.edu, Hans Sebastian Heese, Xinxin Hu

Besides distributing a high-quality software product through a traditional bricks-and-mortar retail channel, software and game developers often also offer a free lower-quality version of the product on-line, hoping that customers later pay for a product upgrade. We analyze the effects of such a dual channel strategy on profitability and product cannibalization.

3 - Direct-Markerting Optimization for Public Broadcasting Stations
Elizabeth Durango-Cohen, Illinois Institute of Technology, 565 W. Adams Street, Chicago, United States of America, durango-cohen@iit.edu, Pablo Durango-Cohen

Our research focuses on the development of direct-marketing strategies for broadcasting stations. We develop a framework that: 1. Identifies segments within the station's listening community; 2. Categorizes marketing actions toward each segment; and 3. Determines the optimal policy to maximize long-run, expected net revenue raised. To solve the problem, we develop an instance of the EM Algorithm to cluster the population into homogeneous segments, and maximize revenues for each segment.

4 - Capacity Investment Strategy with a Salvage Channel
Dennis Yu, Clarkson University, School of Business, Potsdam, NY, 13699, United States of America, dyu@clarkson.edu, Chester Xiang

We study a manufacturer's production capacity and pricing decisions when it is possible to sell surplus inventory through a salvage distribution channel which can be either integrated or independent channel. The impacts of market demand uncertainties on the manufacturer's optimal capacity, retail price decisions, and expected profit are investigated under different channel structures.

■ MA53

H-Room 305, Third Floor

Exact and Heuristic Algorithms for Mixed-Integer Nonlinear Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Pietro Belotti, Lehigh University, Dept of Industrial & Systems Engineering, 200 W Packer Ave, Bethlehem, PA, 18015, United States of America, belotti@lehigh.edu

1 - Convex Envelopes for Bounded Multilinear Function
Mahdi Namazifar, University of Wisconsin, 1513 University Ave, Madison, WI, United States of America, namazifar@wisc.edu, Pietro Belotti, Andrew Miller

We study linear envelopes for the bounded single term multilinear functions. Tight convex relaxations of such functions are sought in order to obtain a lower bound of a non-linear, nonconvex problem whose feasible solutions are defined by multilinear functions. This is motivated by the fact that many exact solvers for nonconvex problems use polyhedral relaxations so as to compute a lower bound via Linear Programming solvers.

2 - Cardinality Bounded Convex Programs

Daniel Bienstock, Columbia University, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu

We present bounding techniques based on the S-lemma and on constrained eigenvalue optimization, for problems involving the optimization of a convex function (in particular, a convex quadratic) subject to non-standard nonconvex constraints (in particular, a bound on the cardinality of the support).

3 - Convexification of Nonconvex Functions and Polyhedral Envelopes

Chuanhui Xiong, Purdue University, Krannert School of Management, West Lafayette, United States of America, cxiong@purdue.edu, Mohit Tawarmalani, Jean-Philippe Richard

In factorable programming, a new variable is often introduced to relax a function that is a composition of a convex and a linear function. We improve the traditional relaxation for such a substitution by developing the convex and concave envelopes of such a function over a hypercube. We then extend the result to polynomial functions of the introduced variables. We apply the results to develop envelopes for certain fractional functions that appear in consistent biclustering problems.

■ MA54

H-Room 306A, Third Floor

Optimization for Online Advertisement I

Sponsor: Optimization/Networks
Sponsored Session

Chair: Vahab S. Mirrokni, Research Scientist, Google Research, 76 9th Ave, 4th floor, New York, NY, 11206, United States of America, mirrokni@gmail.com

1 - Online Story Scheduling in Web Advertising

Hamid Nazerzadeh, Post-doc Researcher, Microsoft Research, One Memorial Dr, Cambridge, MA, United States of America, hamidnz@microsoft.com, Anirban Dasgupt, Arpita Ghosh, Prabhakar Raghavan

We study an online job scheduling problem motivated by storyboarding in web advertising, where an advertiser derives value from uninterrupted sequential access to a user surfing the web. We design online competitive algorithms for this problem.

2 - Incentive Compatible Budget Elicitation in Multi-unit Auctions

Sayan Bhattacharya, Graduate Student, Duke University, Box 90129, Durham, NC, 27708, United States of America, bsayan@cs.duke.edu, Vincent Conitzer, Lirong Xia, Kamesh Munagala

We consider the problem of designing incentive compatible auctions for multiple units of a good, when bidders have private valuations and private budget constraints. When bidders are prevented from over-reporting their budget constraints by randomizing the prices charged, we show the existence of a truthful mechanism that is not only Pareto-optimal but also revenue-optimal. In sharp contrast, it is already known that there is no deterministic mechanism with these properties.

3 - Fair Allocation with Succinct Representation

Saeed Alaei, University of Maryland, AV Williams Bldg, UMD-CP, College Park, MD, 20742, United States of America, saeed.a@gmail.com

we consider the problem of fair allocation in a bipartite supply-demand setting. We capture measure the fairness by a convex penalty function. While this admits a convex programming solution, we strive for more efficient algorithms. For the case of L_1 penalty functions we obtain a simple combinatorial algorithm based on min-cost flow and show how to precompute a linear amount of information such that the allocation along any edge can be approximated in constant time.

4 - Optimizing Budget Constrained Spend in Search Advertising

Aranyak Mehta, Google Research, Mountain View, United States of America, aranyak.mehta@gmail.com, Ramakrishnan Srikant, Anshul Kothari

We study the allocation of budget constrained spend in search engine ad auctions in order to achieve different objectives, such as maximizing the quality of impressions seen by users, or maximizing the ROI of advertisers. We show how to adapt these algorithms to a practical online setting where we need to decide whether to show an ad with a sub-second response time.

■ MA55

H-Room 306B, Third Floor

Sketching in Large Computations

Sponsor: Optimization/Networks
Sponsored Session

Chair: Rina Panigrahy, Researcher, Microsoft Research, 1065 La Avenida, Sunnyvale, CA, 94043, United States of America, rina@microsoft.com

1 - Annotations in Data Streams: Quis Adumbrabit Ipsos Adumbrantes

Andrew McGregor, University of Massachusetts, 140 Governors Drive, Amherst, 01002, United States of America, amcgregor@gmail.com, Amit Chakrabarti, Graham Cormode

Motivated by work in the database community on outsourcing stream processing, we ask whether the memory required by a stream algorithm can be reduced by enlisting a more powerful 'helper' who can annotate the stream as it is read. We do not wish to blindly trust the helper, so we require that the algorithm be convinced of having computed a correct answer. We present optimal algorithms that achieve a nontrivial tradeoff between the amount of annotation used and the memory required to verify it.

2 - Route Planning in Time-Dependent Transportation Networks

Daniel Delling, Microsoft Research SVC, 1065 La Avenida, Mountain View, CA, 94043, United States of America, delling@iti.uni-karlsruhe.de

In this talk, I present an efficient route planning algorithm that works in time-dependent transportation networks. By combining and augmenting basic ingredients from time-independent route planning, we obtain a powerful route planning algorithm, called SHARC. An experimental evaluation shows the feasibility of our approach: The computation of quickest paths in time-dependent continental-sized transportation networks, both of roads and of railways, is a matter of milliseconds.

3 - Hashing for High Dimensional Search

Rina Panigrahy, Researcher, Microsoft Research, 1065 La Avenida, Sunnyvale, CA, 94043, United States of America, rina@microsoft.com

Similarity search in complex objects such as images, documents is often modeled as nearest neighbor search in a high dimensional metric space. This problem of building a data-structure to support nearest neighbor queries is believed to suffer from the 'curse of dimensionality'. We will see some of the best known upper bounds for this problem based on a technique known as Locality Sensitive Hashing. We will also provide an intuition as to why the problem may be fundamentally difficult.

■ MA56

H-Room 307, Third Floor

Portfolio Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Victor DeMiguel, Associate Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, avmiguel@london.edu

1 - A Pathwise Algorithm for Covariance Selection

Alexandre d'Aspremont, Princeton University, Dept of Operations Res & Fin Eng, Princeton University, Princeton, NJ, 08544, United States of America, aspremon@princeton.edu, Vijay Krishnamurthy

Covariance selection seeks to estimate a covariance matrix by maximum likelihood while restricting the number of nonzero inverse covariance matrix coefficients. A single penalty parameter usually controls the tradeoff between log likelihood and sparsity in the inverse matrix. We describe an efficient algorithm for computing a full regularization path of solutions to this problem.

2 - Efficient Estimation of Large Dynamic Multivariate Volatility Models for Portfolio Optimization

Francisco J. Nogales, Associate Professor, Universidad Carlos III de Madrid, Department of Statistics, Madrid, Spain, FcoJavier.Nogales@uc3m.es

In large portfolio selection problems, the estimation of dynamic multivariate volatility models (maximization of a nonlinear likelihood function subject to a constraint ensuring the positiveness of all the conditional covariance matrices) becomes unstable. This is mainly due to the need of inverting all the conditional matrices at each iteration. We propose new multivariate volatility specifications and compare the resulting portfolio performance with that of several recent proposals.

3 - Exploiting Asset Return Predictability for Portfolio Selection
Victor DeMiguel, Associate Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, avmiguel@london.edu, Francisco J. Nogales

There is extensive evidence in the Finance literature about the predictability of asset returns. We explore the use of parametric and nonparametric statistical methods to exploit asset return predictability for portfolio selection, and show that substantial certainty equivalent gains can be achieved.

■ MA57

H-Room 308, Third Floor

Decision Making Strategies in Consumer-Based Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: George Konstantinow, OR-Analysis.com, 142 La Vista Grande, Santa Barbara, CA, 93103, United States of America, george.konstantinow@or-analysis.com

1 - Accuracy and Effectiveness of Outcomes From Evidence-based and Value-based Medicine
John Denning, Principal, WholesaleChange, Inc., P.O. Box 3622, Walnut Creek, CA, 94598, United States of America, j.denning@wholesalechange.com, Anwar Parvez, Robert Morris

Evidence-based medicine is gaining increasingly wider acceptance among medical practitioners. We present a corresponding value-based model of medical and financial decision making that patients and providers may share to assess health care and wellness options. Value-based analytics provide a valuable means for selecting provider service options, including consumer preferences, and judging treatment effectiveness in health care delivery

2 - Rules-Based Assessment of Medical Treatments Based on Health vs. Disease Management
Anwar Parvez, Principal, Wholesale Change, Inc., P.O. Box 3622, Walnut Creek, CA, 94598, United States of America, a.parvez@wholesalechange.com, John Denning, Robert Morris

Medical treatments and their comparative effectiveness vary according to differing cost- and value-based concerns among medical practitioners and consumers. We present a rules engine to assess medical and financial decision paths that patients and providers may use in selecting alternatives among various health care and wellness schemes. Rules-based assessments of treatment cost and effectiveness provide a valuable means for selecting service delivery options in health care economics.

3 - Game Theory and Healthcare - Models for Cooperation and Competition in Consumer-Based Medicine
George Konstantinow, OR-Analysis.com, 142 La Vista Grande, Santa Barbara, CA, 93103, United States of America, george.konstantinow@or-analysis.com

Health care service models reflect high levels of consumer choice in maintaining health and managing disease. We consider strategic decisions that patients, providers, and payers make in selecting treatment paths among various options. We present games that describe competitive and cooperative stakeholder interactions based on provider value and consumer utility. Models of games in health care economics show how healthcare networks behave and how service delivery can be optimized.

■ MA58

H-Room 309, Third Floor

Games on Production Capacity Allocation

Cluster: Scheduling
Invited Session

Chair: Zhixin Liu, Assistant Professor, College of Business, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu

1 - Scheduling Coordination, Contract Design, and Competition for Uncertain Third-party Capacity
Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu

Numerous companies resort to subcontracting as a short-term strategy to increase output, especially when they bid for contracts that require production beyond capacity and timely delivery to customers. On the other hand, subcontracting involves inherent risks such as the competition for and the uncertainties associated with the third-party capacity. In this paper, we study scheduling coordination issues that arise in such a setting, and provide contract forms to achieve centralized performance.

2 - Impact of Transshipment on Retailers
Ruixia Shi, University of Richmond, 1 Gateway Road, Richmond, VA, rxs048100@utdallas.edu, Jun Zhang

This paper analyzes the impact of transshipment on retailers' performance. We analytically demonstrate that retailers are worse off in general when the manufacturer can adjust the wholesale price. We further characterize the conditions under which retailers benefit from transshipment.

3 - Alliance Formation Among Perfectly Complementary Suppliers in a Price-sensitive Assembly System
Shuya Yin, Assistant Professor, University of California-Irvine, Paul Merage School of Business, Irvine, CA, 92697, syin@exchange.uci.edu

Independent parties who produce perfectly complementary components may form alliances to better coordinate their pricing decisions when they sell their products to downstream buyers. This paper studies how market demand conditions drive coalition formation among component suppliers in an assembly system. We show that the size of coalitions formed in equilibrium depends crucially on the demand function, and we use the concept of pass-through rate to interpret these differences.

4 - Batching and Due Date Coordination in Supply Chains
Rui Zhang, McMaster University, 1280 Main Street West, Hamilton, Canada, zhangr6@mcmaster.ca, George Steiner

We study a scheduling problem with delivery costs and due date assignment. We first show it is strongly NP-hardness. Then we provide a pseudo-polynomial algorithm and an FPTAS for the case when due-date-assignment costs are equal. Finally, we propose a polynomial algorithm for the case with uniform due-date-assignment cost and uniform tardiness penalty.

■ MA59

H-Room 310, Third Floor

Tutorial: Geometric Programming

Cluster: Tutorials
Invited Session

Chair: Thomas Jefferson, Doctor, Optimal Duality Institute, P.O. Box 4102, Ormond Beach, FL, 32175-4102, United States of America, trjefferson@hotmail.com

1 - Geometric Programming
Thomas Jefferson, Doctor, Optimal Duality Institute, P.O. Box 4102, Ormond Beach, FL, 32175-4102, United States of America, trjefferson@hotmail.com, Carlton Scott

BEGINNING: Discovery by Zener of a novel way to solve engineering problems and provide closed-form sensitivity analysis. Theory of Geometric Programming developed with Duffin & Peterson. EXTENSIONS: Signomial Programming (Wilde and Passy). Generalized Geometric Programming (Peterson). Applications in engineering, science and business. BACK TO THE FUTURE: Revisit the original method of Legendre Duality to unify theory and solve non-convex problems in economics and business.

■ MA60

H-Room 311, Third Floor

New Advances in Interior-Point Methods: Implementation

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Yuriy Zinchenko, University of Calgary, 2500 University Drive NW, MS446, Calgary, AB, T2N 1N4, Canada, yzinchen@optserv.cas.mcmaster.ca

1 - Semidefinite Programming in Mathematica
Mauricio de Oliveira, MAE/UCSD, 9500 Gilman Dr., Mail Code 0411, La Jolla, CA, 92093, United States of America, mauricio@ucsd.edu

We describe an implementation of an interior-point algorithm for semidefinite programming (SDP) in Mathematica. We take advantage of Mathematica's symbolic capability to develop some unique features. For instance, on small problems with integer or rational data, we allow the use of exact arithmetic to construct a sequence of rational iterates. On large structured problems we use symbolic manipulation to assist the computation of search directions.

2 - Novel Code Optimization Techniques for GPUs
Vasily Volkov, UC Berkeley, 447 Soda Hall, Berkeley, CA, 94720, United States of America, volkov@cs.berkeley.edu

New programming techniques are required to benefit more from the rapid evolution of GPUs. I suggest taking advantage of the fast and uniquely large GPU register files by keeping there the working set and using shared memory for

communication. Also, I argue that running fewer concurrent threads but doing more parallel work per thread may often be a better way of hiding memory latency. Finally, I point to the difficulties in fine-grain global synchronization and trends towards resolving them.

3 - Solving Large-scale Dense SOCP on Heterogeneous Computing Platform

Yuriy Zinchenko, University of Calgary, yzinchen@ucalgary.ca

To minimize negative impact of uncertainties in optimal radiotherapy planning for cancer treatment, a convex robust counterpart of a conventional model has been proposed. The robust model is a large-scale dense SOCP. However, presently, such an approach is clinically infeasible due to excessive computational demands associated with solving the resulting problem. We investigate the use of heterogeneous platforms, namely GP-GPU, to speed up linear algebra operations required by IPM solver.

■ MA61

H-Room 312, Third Floor

New Directions in Location Modeling

Sponsor: Location Analysis
Sponsored Session

Chair: Dmitry Krass, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca

1 - Placement of Warehouse Cross-aisles

Paul Berglund, SUNY University at Buffalo, 786 West Ferry Street, Buffalo, NY, 14222, United States of America, berglund@buffalo.edu, Rajan Batta

This paper investigates the optimal placement of cross-aisles in an order-consolidation warehouse as a consequence of the probability density function of order pick locations. An analytical solution procedure is developed for the optimal placement of a single cross-aisle given an arbitrary probability density of pick locations, which is then generalized to a method for multiple cross-aisles. The result obtained is then checked by a simulation study.

2 - On the Benefits of Risk Pooling in Inventory Management

M. Mahdi Tajbakhsh, Post-doctoral fellow, Rotman School of Management, University of Toronto, 105 St. George st., Toronto, ON, M5S3E6, Canada, Mahdi.Tajbakhsh@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

We study risk pooling in a multi-location newsboy framework. Using common demand distributions, we investigate the sensitivity of the risk pooling benefits to the variability of the individual demands and the number of locations under a variety of common demand distributions. We show that as variability increases, an inventory system goes into "effective shutdown" mode; centralized systems are able to delay shutdown longer.

3 - Optimal Location, Pricing and Capacity Planning under Elastic Demand and Uncertainty

Dehui Tong, Doctorla Candidate, Rotman School of Management, University of Toronto, 105 St. George st., Toronto, ON, M5S 3E6, Canada, Dehui.Tong04@Rotman.Utoronto.Ca, Dmitry Krass, Oded Berman

We study a single-facility system where stochastic demand is sensitive to travel distance, congestion (waiting time) and price. Under some conditions, optimal price is independent of location and capacity decisions and optimal locations are nodal. We investigate when these properties hold and when they break down.

4 - Cooperative Coverage

Dmitry Krass, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca, Oded Berman, Zvi Drezner

A new concept of coverage is proposed: each facility emits a "signal" which decays over distance and each demand point receives the total signal emitted by all facilities; the demand point is covered the total signal exceeds a given threshold. Thus facilities cooperate to provide coverage. We show that this framework generalizes the standard concept of coverage and is appropriate in a variety of applications. Optimal and heuristic algorithms are presented for the planar case.

■ MA62

H-Room 313, Third Floor

Micromotives in Operations Management

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Mirko Kremer, Penn State University, 460 Business Building, State College, United States of America, muk22@psu.edu

1 - An Experimental Study on Customer Perceptions and Behavior in Ticket and Physical Queues

Kaan Kuzu, The Pennsylvania State University, Smeal College of Business SC&IS Department, 471B Business Building, University Park, PA, 16802, United States of America, kaankuzu@psu.edu, Susan Xu

We conduct an experimental study to gain insights into customer perceptions of and behavior within the ticket and physical queue environments. In each environment, we learn how customers form their patience before wait and adapt the patience during wait. We also examine the impact of providing different types of information on the service level in the ticket queue.

2 - Overconfidence in the Newsvendor Problem: An Experiment Study

Yufei Ren, Student, University of Texas at Dallas, 800 W. Campbell Road, Richardson, TX, 75080, United States of America, yxr051000@utdallas.edu, Rachel Croson

A number of behavioral factors have been suggested which might cause suboptimal decisions in supply chain and inventory planning problems, including anchoring and insufficient adjustment, bounded rationality and overconfidence. In this experimental study, we disentangle these underlying causes by measuring an individual's level of overconfidence, anchoring and beliefs and comparing these measures with their decisions in a simplified newsvendor setting.

3 - Designing Contracts for Supply Chains with Irrational But Predictable Newsvendors

Ulrich Thonemann, University of Colgone, Albertus Magnus Platz, Cologne, Germany, Ulrich.Thonemann@uni-koeln.de, Michael Becker-Peth, Elena Katok

Typically, it is assumed that sellers optimize the contract parameters under the assumption that the buyers are placing orders that maximize their expected profits, a decision commonly referred to as rational. We conduct a number of experiments and analyze the buyers' order behavior. We demonstrate that the orders quantities of buyers are not expected profit maximizing, but that they can be predicted quite accurately and build on this information to design various contracts.

4 - Human Demand Forecasting in Times of Change

Mirko Kremer, Penn State University, 460 Business Building, State College, United States of America, muk22@psu.edu, Enno Siemsen, Brent Moritz

Previous research documents the inability of human forecasters to distinguish substantive change from random variation, in settings where a well known phenomenon needs to be detected (e.g. when a bull market turns into a bear market). We investigate this behavioral bias in the context demand forecasting, which is more ambiguous (i.e. future demand distributions are not countable and known) and encompasses many small changes (i.e. traffic patterns, consumer tastes, sense of fashion etc.).

■ MA63

H-Room 314, Third Floor

Joint Session OR Bio/HAS/Homeland:OR in Biodefense

Cluster: OR in Biomedicine and Global Health, Health Applications, & Homeland Security
Invited Session

Chair: Eva Lee, Associate Professor and Director, Georgia Institute of Technology, School of Ind & Sys Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

1 - Public Health as a National Security Issue: New Findings

Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

New research indicates that disasters' physical effects, such as acute respiratory distress, precipitate both physical and psychological effects that may take two years or more to present. This implies that we need to reexamine the whole approach we use to assess the effectiveness of post-disaster acute care and to monitor population health as an early indicator of bioattack. We discuss some implications.

2 - Modeling and Simulation and Quick Look Planning Tools for Pandemic Influenza and Infectious Diseases

Robert Brigantic, Operations Research Scientist, Pacific Northwest National Laboratory, 902 Battelle Blvd., Richland, WA, 99352, United States of America, robert.brigantic@pnl.gov, Aimee Taylor, Courtney Corley

We present an overview of modeling and simulation methodologies employed to examine the potential impacts and mitigative measures associated with pandemic influenza and infectious diseases. We also present quick look planning tools in development that can also assist public health officials with planning activities and consequence management associated with a pandemic, such as the recent Swine Flu outbreak of 2009.

3 - Mitigation Strategies in Response to Bioterrorism or Infectious Disease Outbreaks

Eva Lee, Associate Professor and Director, Georgia Institute of Technology, School of Ind & Sys Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

Mitigation strategies for bioterrorism or infectious disease outbreaks require multilevel efforts: treatment of the ill, protection of the worried-well, voluntary home quarantine, social distancing at work, encouragement of telecommuting, strategic isolation of high-risk school children, and potential closing of schools. We contrast the various levels of protection needed for different scenarios of outbreak and provide some recommendations and guidelines. This work is joint with CDC.

■ MA64

H-Room 202A, Second Floor

Communication Instruction in Engineering and Business Schools I

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Judith Norback, Dir. of Workplace and Academic Communication, Georgia Tech, Stewart School of Industrial and Systems, judith.norback@isye.gatech.edu

Co-Chair: Elke Leeds, Assistant Professor, Kennesaw State University, School of Accountancy Coles College of B, 1000 Chastain Road - Bldg. #4 Office - B, Kennesaw, GA, 30144, eleeds@kennesaw.edu

1 - Managerial Communication Redesign in Executive Business Education

Elke Leeds, Assistant Professor, Kennesaw State University, School of Accountancy Coles College of B, 1000 Chastain Road - Bldg. #4 Office - B, Kennesaw, GA, 30144, eleeds@kennesaw.edu

This presentation examines the redesign of managerial communication in the Coles Executive MBA to: (1) to improve the in-person and electronic oral communication skills of the students in dyadic, meeting, group, and public-speaking environments; (2) to focus these skills on influencing decision makers by advancing a specific purpose; and (3) to tailor these skills and contexts to the individuals' professional needs. Communication touch points have been embedded into the 18-month curriculum and focus on the needs of corporate communication and creating an executive presence.

2 - Addressing the Needs of Non-native English Speaking Students in Technical Communication Classes

Maggie Sokolik, Director, Technical Communication Program, University of California, Berkeley, College of Engineering, sokolik@berkeley.edu

The issues faced by non-native speakers (NNSs) of English in technical communications courses are no longer addressed by placement into English as a Second Language courses. Definitions of 'native speaker' have changed, and so our methods for teaching NNSs are changing. I discuss a program for assessing, placing, and teaching non-native speakers (NNSs) of English in engineering technical communications courses at UC Berkeley. I also discuss the extension of these techniques to an interdisciplinary program at Lawrence Berkeley Laboratories.

3 - Effective and Impactful Assessment of Communication and Presentation Approaches (EIACPA Project)

Gisele Ragusa, Associate Research Professor, University of Southern California, Viterbi School of Engineering, ragusa@usc.edu

This presentation provides research on effective assessment metrics for determining the impact of communication approaches and presentation skills. This researcher has designed a set of assessment rubrics that provide "just in time" feedback to the presenter as a real time learning tool for formative improvement of their communication and presentation skills, and summative evaluative metrics to judge and quantify the impact of the presenter's approach. These assessment metrics have been field tested and validated. The results of a recent study will be presented.

■ MA75

C-Room 32A, Upper Level

Practical Application of OR in Rail Industry

Sponsor: Railroad Applications
Sponsored Session

Chair: April Kuo, Senior Operations Research Specialist, BNSF Railway, 2400 Westerncenter Blvd, Fort Worth, TX, 76131, United States of America, April.Kuo@BNSF.com

1 - Risk-Based Railroad Tank Car Safety Design Optimization

Rapik Saat, Graduate Research Assistant, University of Illinois at Urbana-Champaign, B-118 NCEL, MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, mohdsaat@illinois.edu, Christopher P.L Barkan

We will present a quantitative model that accounts for chemical-specific hazard and the consequent benefits and costs to determine the optimal tank car safety design to reduce the risk of transporting hazardous materials. This model is intended to provide a framework to consider cost-effectiveness of using more robust tank car designs to replace an existing tank car fleet in any hazardous material service.

2 - Optimizing the Routing of Trains with Heterogeneous Traffic

Yung-Cheng Lai, Assistant Professor, National Taiwan Universtiy, Rm 313, Civil Engineering Bldg, No 1, Roosevelt Rd, Sec 4, Taipei, 10617, Taiwan - ROC, yclai@ntu.edu.tw, Christopher P.L Barkan, Mark Dingler, Mei-Cheng Shih

Efficient usage of capacity requires understanding how the mixture of traffic interacts to affect capacity. In this research, we develop a new decision support tool to help service design managers determine the most efficient way to route heterogeneous trains through the network. This tool will help railroads maximize the transportation efficiency and thus be better able to provide reliable service to their customers.

3 - Effectively Solving Production Gang Scheduling Problem for Railway Track Maintenance Projects

Gang Li, The University of Texas at Austin, The University of Texas at Austin, Austin, TX, United States of America, gang.li@mail.utexas.edu, Anant Balakrishnan, Brian Roth

The Production Gang Scheduling (PGS) problem seeks to select and assign production gangs to railway track maintenance jobs, sequence the jobs, and route gangs among jobs to minimize the total cost for employing, assigning, and repositioning gangs. The PGS problem has received significant attention in recent years, but solving the problem effectively continues to be challenging. We discuss successful algorithmic approaches for solving this problem.

4 - Ballast Procurement and Delivery Optimization

Xiajun (Amy) Pan, University of Texas at Austin, 1, University Station, Austin, United States of America, Xiajun.Pan@phd.mccombs.utexas.edu, Anant Balakrishnan, Brian Roth

To support annual ballast supply planning for track maintenance projects, we propose an integer programming model that decides the quarry for each project, schedules full-load deliveries to each job site before its project start date, and routes the available trains to make these deliveries. The objective is to minimize the total procurement, vehicle routing, and delivery cost. We describe valid inequalities to strengthen the model, and report on successful computational results using real data.

5 - Freight Tariff Design for Multi-product Multimodal Networks: An MPEC Approach

Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Kuilin Zhang, Jing Dong

We seek to design an optimal tariff scheme for rail freight service, explicitly considering shippers' joint mode and route choice behavior. The problem is formulated as a mathematical program with equilibrium constraints (MPEC), with the objective of maximizing profit of rail carriers and the constraints of achieving stochastic user equilibrium (SUE) network flow pattern. The model is applied to an international rail-based intermodal freight corridor network in Europe.

Monday, 11:00am - 12:30am

■ MB01

C-Room 21, Upper Level

Using Decision Analysis/Value of Information to Improve Defense Against Attacks

Sponsor: Decision Analysis
Sponsored Session

Chair: Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - Trading off Target Hardening Against Overarching Protection
Naraphorn Haphuriwat, naraphoh@cae.wisc.edu, Vicki M Bier

Defenders concerned about protecting multiple targets can protect them either by hardening individual target, or through overarching protections such as border security. Decision-makers may find it difficult to compare such seemingly incommensurate forms of protection. We develop a model for trading off target hardening against overarching protection, and investigate how the optimal tradeoff depends on factors such as the number of targets and the distribution of target valuations.

2 - Jamming Radio-Controlled Improvised Explosive Devices with Reactive Jammers
Kyle Lin, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd, Monterey, CA, 93943, United States of America, kylin@nps.edu

A reactive jamming device first scans the entire frequency spectrum to detect radio signals before deciding which frequency bands to jam. In an urban area, however, there are usually a lot of background radio traffic (besides an RCIED detonation signal) that can confuse the reactive jammer. This talk presents a game-theoretic approach to quantify the effect of the background radio traffic on the reactive jammer's performance.

3 - Defending Against Multistage Attacks under Uncertainty: A Non-Cooperative Non-Zero-Sum Game Approach
Yi Luo, University of Arizona, Department of Systems and Industrial Engineering, 1127 E. James E. Rogers Way, Tucson, AZ, 85721-0020, United States of America, luo1@email.arizona.edu, Youssif Al-Nashif, Salim Hariri, Ferenc Szidarovszky

The interactions between the attacker and the administrator can be modeled as a non-cooperative non-zero-sum dynamic game with incomplete information. Since calculating the equilibrium strategies within certain time horizons cannot provide optimal responsive strategies to the administrator, a new and fast algorithm RMO is developed. The numerical experiments show that the RMO algorithm can largely reduce the impact of the attack to the system and more efficient than the other algorithms.

4 - Optimal Defensive Allocations Based on Realistic Attacker Objective Functions
Chen Wang, University of Wisconsin-Madison, 3237 Mechanical Engineering, 1513 University Ave, Madison, WI, 53706, United States of America, cwang37@wisc.edu, Vicki M Bier

We extend existing game-theoretic models of optimal defensive resource allocations from simple "toy problems" to realistic multi-attribute attacker objective functions. We explore how such decisions depend on the cost effectiveness of defensive investment, the defender's uncertainty about the weights placed by attackers on different attributes such as attack difficulty vs. damage, and the presence of attributes that are important to the attacker but not known to the defender.

5 - Robust Defensive Resource Allocations in the Face of Strategic and Non-strategic Adversaries
Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Xiaojun Shan

Allocating homeland security resources is a challenging problem. In this paper, we study the robust defensive resource allocation, considering the fact that the adversary (terrorist, attacker) could be either strategic or non-strategic. We develop algorithms to solve this problem and provide both analytical and numerical results. We also study the sensitivities of the robust defensive resource allocations and defender payoffs to various assumptions about the adversary behavior.

■ MB02

C-Room 22, Upper Level

Normative Models for Multiattribute Utility Functions

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu

1 - Graphical Representations of Independence for Multiattribute Utility Functions
Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu

We present a graphical representation of preferences, which we call the bidirectional utility diagram, that captures the asymmetric nature of utility independence in decisions with multiple attributes. We also introduce a new expansion theorem for multiattribute utility functions that generalizes the functional form of Bayes' expansion theorem. We show how special cases of this formulation lead to well-known functional forms of utility independence found in the literature.

2 - Consumption and Portfolio Planning Using Multilinear Preferences
Casey Lichtendahl, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, lichtendahlc@darden.virginia.edu, Raul Chao, Sam Bodily

Making lifetime plans about consumption and investment in risky assets is a fundamental economic challenge. Contrary to empirical evidence, leading solutions to this problem recommend erratic consumption plans that move with every instantaneous uptick and downtick in the stock market. We show that a solution to this problem using multilinear preferences recommends consumption plans that are smooth with respect to the noise in the stock market—-something no additive preference model can do.

3 - Combining Good with Bad and Multivariate Stochastic Dominance
Ilia Tsetlin, Insead, 1 Ayer Rajah Ave, Singapore, 138676, Singapore, ilia.tsetlin@insead.edu, Robert Winkler

We develop the notions of concave and convex multivariate stochastic dominance, defined through a preference for combining good lotteries with bad ones versus combining good with good and bad with bad. We explore connections with existing concepts of multivariate stochastic dominance and discuss implications for multiattribute decision analysis. Our results also add intuition to such notions as correlation aversion, cross-prudence, and cross-temperance.

■ MB03

C-Room 23A, Upper Level

Game Theory II

Cluster: Game Theory
Invited Session

Chair: Amin SaberiProfessor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

1 - Stochastic Submodular Optimization
Arash Asadpour, Ph.D. Candidate, Stanford University, Terman Engineering Building, Room 323, Stanford University, Stanford, CA, 94305, United States of America, asadpour@stanford.edu, Amin Saberi, Hamid Nazerzadeh

We study stochastic submodular maximization problem with respect to a cardinality constraint. Our model can capture the effect of uncertainty in different problems, such as cascade effects in social networks, capital budgeting, sensor placement, etc. We study non-adaptive and adaptive policies and give "optimal" constant approximation algorithms for both cases. We also show that the adaptivity gap in this setting is 1.59.

2 - Social Influence and Evolution of Market Share
Simla Ceyhan, PhD Candidate, Stanford University, Terman Engineering Building, Room 391, Stanford, CA, 94305, United States of America, simlac@stanford.edu, Mohammad Mousavi, Amin Saberi

We propose a model for the evolution of the market share in the presence of social influence. Using techniques from stochastic approximation theory, we show that market share converge to an equilibrium that can be derived in terms of the level of social influence and inherent fitness of the products. We also show that when the choice model is multinomial logit model, inequality in the market increases with social influence and with strong social influence, monopoly occurs.

3 - Online Stochastic Matching: Beating 1-1/e
Vahab S. Mirrokni, Research Scientist, Google Research, 76 9th Ave, 4th floor, New York, NY, 11206, United States of America, mirrokni@gmail.com, Jon Feldman, Muthu Muthukrishnan, Aranyak Mehta

Motivated by online display ad allocation, we study the online stochastic bipartite matching problem in the iid model. Our main result is a 0.67-approximation online algorithm for this problem, breaking the 1-1/e barrier. Furthermore, we show a hardness result that achieving a PTAS is impossible. In our algorirthm, we employ the idea of the power of two choices by computing two disjoint solutions to expected instance, and use them in the online algorithm.

■ MB04

C-Room 23B, Upper Level

Auctions and Competitive Bidding

Cluster: Auctions
Invited Session

Chair: Octavian Carare, University of Texas at Dallas, 800 W Campbell Rd, Richardson, United States of America, carare@utdallas.edu

1 - Mergers in Repeated Auctions with an Incumbent Advantage
Mikhael Shor, Vanderbilt University, Nashville, TN, United States of America, mike.shor@owen.vanderbilt.edu, Luke Froeb

When the winner of one auction gains a cost advantage in the next, bids reflect not only the value of winning the auction, but also the value of gaining an incumbent advantage in future auctions. Firms face an inter-temporal trade-off between 'harvesting' incumbency status by bidding less aggressively, and 'sowing' incumbency for the next period by bidding more aggressively. We study mergers in this context. The presence of incumbent advantage makes many mergers pro-competitive.

2 - Competition in Art Auctions
Martin Schreiber, PhD Candidate, University of Texas at Dallas, 800 West Campbell Road, SM32, Richardson, TX, 75080, United States of America, mrs055000@utdallas.edu

The study examines the impact of competition between and within art auctions using auction data of Christie's and Sotheby's between 1990 and 2008.

3 - Speculation and Demand Reduction in English Clock Auctions with Resale
Krista Jabs Saral, Florida State University, Department of Economics, 113 Collegiate Loop, Tallahassee, FL, 32306-2180, United States of America, kkj8919@fsu.edu

I theoretically and experimentally examine how the existence of an inter-bidder secondary resale market opportunity impacts bidder behavior in an English clock auction, and to what extent altering the bargaining power of the final buyer and reseller in the resale market determines the strategies followed in the initial auction.

4 - Minority Subcontracting Goals in Government Procurement Auctions
Dakshina De Silva, Associate Professor, Texas Tech University, Department of Economics, Lubbock, TX, 79409, United States of America, dakshina.de-silva@ttu.edu, Timothy Dunne, Georgia Kosmopoulou, Carlos Lamarche

Affirmative action policies for disadvantage business enterprises (DBE) have been under scrutiny for the past 19 years. Such policies have been in place for countering the effects of past discrimination. Their goal has been to enhance the economic strength of minorities and stimulate competition. The opponents of those policies claim that they resulted in reverse discrimination. We use TxDOT data to investigate the effect of DBE goals on participation and the cost of contracting. We apply matching and structural estimation techniques to study differences in the costs.

■ MB05

C-Room 23C, Upper Level

2009 INFORMS Best Paper Award in the Quality, Statistics, and Reliability (QSR) Section

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi GebraeelAssistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, nagi@isye.gatech.edu

1 - A Bayesian Approach to Risk-adjusted Change Detection in Healthcare
Li Zeng, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, LZENG1@WISC.EDU, Shiyu Zhou

Outcomes in medical processes are important measures of care providers' performance. One key challenge in the detection of performance change using outcomes is the need of adjustment for patient base-line risks. This article proposes a Bayesian approach to risk-adjusted detection of performance change.

2 - Bayesian Optimal Single Arrays for Robust Parameter Design
Lulu Kang, Ph.D. Candidate, School of Industrial and Systems Engineering, Georgia Tech, 350440 Gerogia Tech Station, Atlanta, GA, 30332, United States of America, lulu@gatech.edu, Roshan Vengazhiyil

It is critical to estimate control-by-noise interactions in robust parameter design. We propose a Bayesian approach to develop single arrays which incorporate the importance of control-by-noise interactions without altering the effect hierarchy. The approach is very general and places no restrictions on the number of runs or levels or type of factors or type of designs. It is also applied to design experiments with internal noise factors; a topic that has received scant attention in literature.

3 - Sequential Bayesian Decision Making for End-Point Detection of Chemical Mechanical Planarization
Omer Beyca, Oklahoma State University, Stillwater, OK, 74078, United States of America, omer.beyca@okstate.edu, Ranga Komanduri, Zhenyu (James) Kong, Satish Bukkapatnam

AbstractóIn Chemical Mechanical Planarization, endpoint detection decisions are important to enable the process to respond to demand variations and disruptions. In this paper, we apply the sequential Bayesian decision making to establish a relationship that connects the measured sensor signals with the material removal for end-point detection of the process. index Termsó Chemical Mechanical Planarization (CMP), Endpoint Detection (EPD), Sequential Bayesian Decision Making.

4 - Degradation Modeling of Complete,Sparse and Fragmented Degradation Signals
Rensheng Zhou, PhD Graduate Student, Georgia Tech, 1903 DREW Dr. NW Rm1202, atlanta, United States of America, rzhou8@gatech.edu, Nagi Gebraeel, Nicoleta Serban

This paper presents a non-parametric degradation modeling framework for characterizing degradation signals of partially degraded engineering systems. We focus on modeling different types of degradation signals to predict the distribution of a system's residual life using real-time degradation signals. We consider complete signals, sparse signals and fragmented signals which are densely observed at disjoint time intervals. The approach is validated using degradation data of bearings.

■ MB06

C-Room 24A, Upper Level

Quality and Statistical Decision Making in Health Care Applications I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Assistant Professor, Arizona State University, Tempe, AZ. United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, huiyang@eng.usf.edu

1 - An Artificial Neural Network to Quantify Breast Cancer Risk Based on Mammography Findings
Turgay Ayer, University of Wisconsin, 1513 University Ave., Madison, WI, 53708, United States of America, tayer@wisc.edu, Oguzhan Alagoz, Charles Kahn, Elizabeth Burnside, Jagpreet Chhatwal, Jude Shavlik

Although breast cancer is the most common cancer among US women, current methods in practice for diagnosis have low positive predictive values. Unfortunately, no diagnostic system has achieved perfect discrimination, so radiologists must make decisions under substantial uncertainty. We built an artificial neural network (ANN) based on a large dataset to discriminate between cancerous and noncancerous lesions and accurately predict the probability of breast cancer for individual patients.

2 - Multiscale Recurrence Model for Biomedical Diagnostic Applications
Satish Bukkapatnam, Professsor, Oklahoma State University, School of Industrial Engineering and Man, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu, Hui Yang

This paper presents a multiscale recurrence model for the identification of myocardial infarction subjects. Few, if any, of previous approaches study the recurrent dynamics from the cardiac state space constructed with three orthogonal vectorcardiogram (VCG) signals in the wavelet domain. The proposed approach is found to achieve classification performances very close to the human experts and better than traditional automated algorithms.

3 - Learning Brain Connectivity of Alzheimer's Disease by Exploratory Graphical Models

Shuai Huang, PhD Student, Arizona State University, 1025 Orange St, La Cresenta, RM-G220, Tempe, AZ, 85281, United States of America, shuang31@asu.edu, Jing Li

This paper proposes an exploratory graphic model called inverse covariance to model the functional brain connectivity of three study groups including AD, MCI, and normal aging subjects. The developed model is applied to PET data collected when subjects are at their resting state. Results are consistent with previous findings in the literature. Some new aspects are also revealed with added value to the current connectivity research, and are worthy of further investigation.

■ MB07

C-Room 24B, Upper Level

Reliability and Risk Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Refik Soyer, George Washington University, 2201 G Street NW, Funger Hall 415, School of Business, Washington, DC, 20052, United States of America, soyer@gwu.edu

1 - Predictive Information for Reliability Analysis

Ehsan Soofi, Professor, University of Wisconsin-Milwaukee, Sheldon B. Lubar School of Business, P.O. Box 742, Milwaukee, WI, 53201, United States of America, esoofi@uwm.edu, Nader Ebrahimi, Refik Soyer

We examine relationships between measures of information provided by the sample for prediction and about the parameter when the observations are conditionally independent given the parameter and for the order statistics. We also compare predictive information provided by a sample of all failure times and a sample that includes some survival times. Applications to a large family of distribution which contains many well-known lifetime models will be presented.

2 - Duration Models for Mortgage Default Risk

Feng Xu, Assistant Professor of Management, Georgia Southwestern State University, 800 GSW State University Drive, Americus, GA, 31709, United States of America, fengxu@gwmail.gwu.edu, Refik Soyer

In this talk we present duration type models to analyze mortgage default risk. We provide proportional hazards type generalized gamma and mixture models, with which the nonmonotonic default behavior of residential mortgage loans can be captured effectively. Besides, we develop Bayesian inferences for our models and illustrate their implementation using actual time to default data from the U.S. residential mortgage market.

3 - Reliability Growth Prediction for Multi Stage Systems

Thomas Mazzuchi, George Washington University, 1776 Gst NW, Washington DC, United States of America, mazzu@gwu.edu, Jennifer Nicholls, Shahram Sarkani

In this presentation we develop a Bayesian reliability growth model for multisatge systems which takes in to account test and field ddata and allows for potentially different growth rates for each phase.

4 - The Variability Associated with Bayesian Group Maintenance Policies

John Wilson, University of Western, John G. Wilson, Ivey School of Business, ON, Canada, jwilson@ivey.uwo.ca, Elmira Popova

In the literature on replacement / maintenance policies for systems of stochastically failing machines, it is generally assumed that the failure time parameters are known and the objective is to find a replacement policy that minimizes expected cost per unit of time. In practice, however, the variability of costs can be an important consideration. In addition, most managers would want to adapt to new information obtained while operating the machines. In this paper, a class of policies is analyzed where the manager is allowed to adapt the replacement policy according to the statistical information obtained while operating the machines. It will be demonstrated that it is feasible to explicitly calculate both the expected cost per unit time and the variance associated with this class of replacement policies.

■ MB08

C-Room 24C, Upper Level

Joint Session QSR/Data Mining: Multi-factor Approaches to Risk Analysis and Threat Determination

Sponsor: Quality, Statistics and Reliability & Data Mining Sponsored Session

Chair: Artur Dubrawski, Adjunct Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awd@cs.cmu.edu

1 - Risk-Informed Decision Framework for Integrated Chem/Bio Risk Assessment and Management

Igor Linkov, Risk and Decision Science Focus Area Lead, US Army ENgineer Research and Development Center, 83 Winchester Str, Suite 1, Brookline, MA, 02446, United States of America, Igor.Linkov@usace.army.mil, Steven Bennett, Sara Klucking, Todd Bridges, Alex Tkachuk, Natasha Hawkins

This presentation will focus on current and evolving risk management approaches to a wide range of available CBRN countermeasures, taking into account their functional and economical criteria, possible threats and potential targets. It will include discussion on the current DHS need, summaries of probabilistic risk assessment currently implemented by DHS as well as proposed decision-analytical and portfolio-based risk management tools.

2 - Combining Contextual Information and Radiation Measurement Factors for Nuclear Threat Determination

Simon Labov, Physicist, Lawrence Livermore National Laboratory, P.O. Box 808, L-181, Livermore, CA, 94550, United States of America, slabov@llnl.gov, Yiming Yao, John Ostlund, Michael Pivovaroff, Karl Nelson, Dov Cohen, Artur Dubrawski, Saswati Ray

One of the most critical challenges in national security is the detection of a nuclear or radiological weapon in the midst of common radioactive materials. We are developing a unique approach that combines factors from contextual information (e.g., location, goods description, etc.) and multiple radiation sensors to provide threat determination analysis. We use machine learning algorithms and physics-based techniques for text enumeration, feature extraction and threat classification.

3 - Time Series-based Data Mining Methods Applied to Aircraft Fleet Operational Risk Management

Norman Sondheimer, University of Massachusetts Amherst, Computer Science Department, Amherst, MA, 06001, United States of America, sondheimer@cs.umass.edu, Artur Dubrawski

This presentation argues that time series-based methods from data mining can be used to manage operational risk in the management of aircraft fleets for higher availability and lower cost. It describes the problem space, proposes a model to employ, compares the model to well-known alternatives, gives examples from experiments with the management of a large fleet, and ends with a set of challenge problems for the field.

4 - Practical Data-driven Methods of Risk Estimation in Food Safety Applications

Artur Dubrawski, Adjunct Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awd@cs.cmu.edu, Lujie Chen, Daria Sorokina

Food safety is an important prerequisite of public well being. We present selected data-driven methods of risk estimation applied to model positive results of microbial tests of food samples collected at production plants. Knowledge of risk enables proactive allocation of investigative resources and it supports studies into mitigation of food-borne threats to public health. We illustrate empirical utility of the presented methods using a record of tests against various serotypes of Salmonella.

■ MB09

C-Room 25A, Upper Level

Applications in Revenue and Operations Management

Sponsor: Applied Probability
Sponsored Session

Chair: Hernan Awad, University of Miami, Department of Management Science, Coral Gables, FL, 33124-6544, United States of America, h.awad@miami.edu

1 - Optimal Flexibility Configurations in Newsvendor Networks: Going Beyond Chaining and Pairing
Achal Bassamboo, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, 60208, a-bassamboo@kellogg.northwestern.edu, Jan Van Mieghem, Ramandeep Randhawa

In this talk, we characterize optimal flexibility configurations in newsvendor models. We find that though chaining configurations yield good performance, they are not optimal in general, and one has to add additional flexibility. Further, we show that when faced with arrival rate uncertainty, queueing systems reduce to newsvendor models, and thus our results apply to these settings as well.

2 - Optimal Dynamic Assortment Planning
Denis Saure, Columbia University, 3022 Broadway, Uris Hall, 4N, New York, NY, 10025, United States of America, dsaure05@gsb.columbia.edu, Assaf Zeevi

We study a family of stylized assortment planning problems, where arriving customers make purchase decisions among offered products based on maximizing their utility. By offering different assortments and observing purchase behavior, the retailer learns about consumer preferences, but experimentation should be balanced with exploitation of this knowledge. We develop dynamic policies that balance the aforementioned trade-off, and prove that the performance of these policies is best possible.

3 - A Characterization of the Value of Uncensored Demand in Inventory Management
Omar Besbes, Columbia University, Graduate School of Business, 3022 Broadway, Uris Hall, New York, 10027, United States of America, ob2105@columbia.edu, Alp Muharremoglu

We consider a newsvendor problem where the decision-maker does not have access to the underlying distribution of demand. We provide a characterization of the best achievable performance in the cases where demand observations are censored and uncensored, thereby quantifying the performance degradation stemming from demand censoring.

4 - Inventory Control Policies for Fixed-life Perishable Products
Hernan Awad, University of Miami, Department of Management Science, Coral Gables, FL, 33124-6544, United States of America, h.awad@miami.edu

We study the problem of a firm manufacturing a perishable product (with a fixed deterministic shelf-life), who must choose its production/inventory policy to minimize the costs of unsatisfied demand, inventory holding and product outdating. For a parameter regime of high demand and production rates, we formulate a diffusion approximation to the system and, based on it, develop production/inventory policies that attain good performance. Joint work with Mariana Olvera-Cravioto.

■ MB10

C-Room 25B, Upper Level

Computation/Communication Resource Management

Sponsor: Applied Probability
Sponsored Session

Chair: Lydia Chen, Visiting Scientist, IBM Zurich Research Lab, 4 Sauemerstrasse, Rueschlikon, Switzerland, YIC@zurich.ibm.com

1 - The Optimality of Security-Level Strategies in Adversarial Settings
Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

We consider devising a pit stop strategy in Formula One (F1) racing. We formulate an F1 race as a full-information game in Nash and show how to solve for competitor utility profiles from data. We show that the game compels risk-averse play and matches well with a game class where security-level strategies are optimal. We conclude by showing that our game-theoretic approach outperforms other methods, and discuss the application of our methods to other domains like R&D portfolio investment.

2 - The Content Management for P2P IPTV System
Lydia Chen, Visiting Scientist, IBM Zurich Research Lab, 4 Sauemerstrasse, Rueschlikon, Switzerland, YIC@zurich.ibm.com

We propose a stochastic framework to study content management policiesfor the hierarchical IPTV system with the option of peer content sharing. The steady state analysis provides the content distribution, which is used to evaluate the efficiency of the peer-sharing of network and storage resources. We show that dynamic content management with different degrees of peer collaborations can be nearly optimal, with respect to the video popularity and system specifications.

3 - Input-Output Similarities at FIFO Queues
Florin Ciucu, T-Labs / TU-Berlin, Ernst-Reuter-Platz 7, Berlin, 10587, Germany, florin@net.t-labs.tu-berlin.de

A recent approach for queueing analysis proposed a bounding representations of arrivals and service. In this talk we address input-output relationships at a FIFO queue with multiple arrival flows. In particular, we show that for a broad class of arrivals the input and output of a single flow have very similar bounds. This result indicates that queues in a network can be treated in isolation of each other, thus considerably simplifying the end-to-end analysis.

4 - Adaptive Resource Allocation in Data Centers
Natarajan Gautam, Texas A&M University, 3131 TAMU, 235A Zachry, College Station, TX, 77843, United States of America, gautam@tamu.edu, Cesar Rincon Mateus

We study the Energy Aware Dynamic Resource Allocation problem for data centers. We propose a decision making scheme that efficiently adapts to system behavior changes consisting of a reactive mechanism that uses the information about the current state of the system, and a proactive mechanism that is based on information obtained from a novel custom-made forecasting procedure. The scheme is highly adaptive to system conditions and/or disruptions.

■ MB11

C-Room 25C, Upper Level

Homeland Security and Counterterrorism

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Lawrence M Wein, Stanford University, Graduate School of Business, Stanford, CA, United States of America, wein_lawrence@gsb.stanford.edu

1 - Inference and Interdiction in a Terror Queue Model
Edward H Kaplan, William N and Marie A Beach Prof of Mgt Sciences, Prof of Public Health and Prof of Engineering, Yale University, School of Management, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, edward.kaplan@yale.edu

We continue our discussion of a new queueing model relating terror threats and their detection by HUMINT agents to understand how preventive counterterror measures and HUMINT combine to interdict terror suspects. We also gauge the number of undetected terror plots in progress from the known utilization of HUMINT agents.

2 - Securing the Containerized Supply Chain: Analysis of Government Incentives for Private Investment
Nitin Bakshi, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nbakshi@london.edu, Noah Gans

To mitigate the threat of terrorists smuggling weapons of mass destruction (WMD) into the US through maritime containers, the US Bureau of Customs and Border Protection (CBP) inspects containers upon entry to domestic ports. Inspection-driven congestion is costly, and CBP provides incentives to firms to improve security upstream in the supply chain, thereby reducing the inspection burden at US ports. We perform a game-theoretic analysis of this incentive program.

3 - An Overlapping Networks Approach to Counterterrorism Resource Allocation
Michael Atkinson, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, mpatkins@nps.edu, Lawrence Wein

We formulate a model to identify terrorists through their participation in criminal networks such as money laundering and dealing in illicit drugs. The government allocates resources among these networks to maximize the number of terrorists identified, but has only limited information about the structures of these networks. The government performs both an initial global investigation and a secondary local investigation. We illustrate the model with data from the American Terrorism Study.

■ MB12

C-Room 26A, Upper Level

Advances in LP Modeling of Combinatorial and Stochastic Optimization Problems

Sponsor: Computing Society
Sponsored Session

Chair: Moustapha Diaby, Associate Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06268, United States of America, moustapha.diaby@business.uconn.edu

1 - Transportation Problem-Based Heuristics for the Set Partitioning Problem

Aaron Nsakanda, Associate Professor, Carleton University, Sprott School of Business, 1125 Colonel By Drive, Ottawa, ON, K1S 3B6, Canada, aaron_nsakanda@carleton.ca, Anito Joseph-Phillip, Moustapha Diaby

We propose a new, graph-based modeling approach for the Set Partitioning Problem. The approach is illustrated with a numerical example. Computational testing and results are discussed.

2 - Pattern Recognition Techniques in Stochastic Programming

Miguel Lejeune, Assistant Professor, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

A new modeling framework based on pattern recognition techniques is proposed for the solution of stochastic programming problems. The method involves the binarization of the probability distribution and the generation of a disjunctive normal form representing sufficient conditions for stochastic constraints to hold. The disjunctive normal form is modeled as a collection of logical patterns. A mathematical programming approach is used to construct the patterns.

3 - Concise RLT Forms of Binary Programs: A Computational Study of the Quadratic Knapsack Problem

Richard Forrester, Associate Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States of America, forrestr@dickinson.edu, Warren Adams, Paul Hadavas

The RLT is a methodology for constructing tight LP relaxations of mixed discrete problems. A key construct is the multiplication of "product factors" of the discrete variables with problem constraints to form polynomial restrictions, which are subsequently linearized. We examine the usefulness of subsets of constraints for the 0-1 quadratic knapsack problem. We consider RLT forms both with and without these inequalities, and their comparisons with linearizations derived from published methods.

4 - Generalized Framework for Formulating "Hard" Combinatorial Optimization Problems as Linear Programs

Moustapha Diaby, Associate Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06268, United States of America, moustapha.diaby@business.uconn.edu

In this talk, we will present a general framework for formulating "hard" combinatorial optimization problems as linear programs (LP's). Insights into why traditional IP modeling approaches fail (w.r.t. to formulating problems as LP's) will be discussed. Some numerical illustrations of the proposed general framework will also be discussed.

■ MB13

C-Room 26B, Upper Level

Computational Stochastic Integer Programming

Sponsor: Computing Society
Sponsored Session

Chair: David Morton, Professor, The University of Texas at Austin, Graduate Program in Operations Research, 1 University Station C2200, Austin, TX, 78712, United States of America, morton@mail.utexas.edu

1 - Nuclear Medicine Patient and Resource Scheduling via Stochastic Integer Programming

Eduardo Perez, Graduate Student, Texas A & M University, 3131 TAMU, College Station, TX, United States of America, eduardopr@neo.tamu.edu, Cesar O. Malave, Lewis Ntaimo

Nuclear medicine (NM) procedures use radioisotopes for diagnosis and treatment of patients, involve multiple steps, and have to be performed under strict time constraints and uncertainty in patient/radioisotope arrivals. This makes the problem of NM patient service management very challenging. We present stochastic integer programming models for NM patient/resource scheduling within a stochastic online optimization framework. A computational study based on an actual NM clinic will be presented.

2 - Parallelization of Progressive Hedging Revisited: Asynchronous Convergence and Scenario Bundling

David Woodruff, Professor, University of California Davis, UC Davis, Davis, CA 95616, Davis, CA, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson

Although Progressive Hedging is naturally parallelizable, a number of unexplored issues arise for efficient implementation. In particular, asynchronous sub-problem solves facilitate improved efficiency, but may adversely impact algorithm convergence. Similarly, intelligent bundling of scenarios may accelerate local convergence, but degrade global convergence. We explore the practical implementation of these techniques, and discuss computational results on various test problems.

3 - Prioritization via Stochastic Optimization

Ali Koc, The University of Texas at Austin, alikoc@mail.utexas.edu, David Morton, Elmira Popova

The operations research literature handles activity selection problems by forming an optimal portfolio of activities, as opposed to a common approach in industry which forms a prioritized list. We develop a novel prioritization approach incorporating both views. We illustrate our approach on stochastic k-median and capital budgeting models. We formulate two-stage and multi-stage stochastic integer programs and develop valid inequalities. We use parallel branch-cut-price to improve solution time.

■ MB14

C-Room 27A, Upper Level

Optimization in Practice II - Manufacturing

Sponsor: Computing Society
Sponsored Session

Chair: Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

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

1 - Integrating Inventory Optimization and Supply Chain Network Optimization Models

Jeremy Shapiro, Professor Emeritus, MIT, 226 Commonwealth Ave., Boston, MA, 02116, jfsinc@attglobal.net

Supply chain network optimization models are applied to strategic planning problems involving facility location decisions and tactical planning problems involving production and distribution decisions. We discuss how modeling artistry can be employed to incorporate inventory decisions about safety stocks and replenishment quantities in network optimization models. A successful case study will be presented.

2 - Prescriptive Analytics Produces Millions in Profits in Manufacturing

Andrew Bielat, President & CEO, EIS Analytics, 16004 NE 203rd Court, Brush Prairie, 98606, United States of America, abielat@eisanalytics.com

EIS Analytics has taken analytics to a new level for manufacturing clients that industry experts have christened "persecriptive analytics". Using LP, heuristics, Monte Carlo simulations and other analytical techniques, combined with Activity Based Costing and an in depth understanding of organizational dynamics, their Profit InSight tools are making clients millions of dollars a year in profit.

3 - MPS Optimization

Robert Wang, Sr. Business Analyst, Nestle USA, 800 N. Brand Blvd., Glendale, CA, 91203, United States of America, robert.wang@us.nestle.com

A MIP model was developed to optimize master production schedule, which was maintained manually in the past. The model minimizes the total costs including inventory, change over, production, shortage and salvage. Sequence dependent change over is specifically addressed in the model. About 40% inventory reduction has been attained.

4 - Integration of Systems, Process and Optimization at Hub Group

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

This talk presents a multi-component DSS which combines forecasting and statistics with heuristics and optimization to provide yield management and load dispatching capabilities at Hub Group, the largest Intermodal marketing Company in the U.S. We discuss the challenges of living within existing organizational, system and process constraints when developing new O.R.-based decision technology.

■ MB15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Innovative Scheduling - Case Studies From the Field: What It Takes to Turn Models into Systems

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

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

2 - Maximal Software - Why is Maximal Software Now Giving Away Free Development Copies of MPL?

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

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

■ MB16

C-Room 28A, Upper Level

Information Security

Sponsor: Information Systems
Sponsored Session

Chair: Dmitry Zhdanov, University of Connecticut, 2100 Hillside Rd, Storrs, CT, 06269, United States of America, Dmitry.Zhdanov@business.uconn.edu

1 - Personal Data Protection: Economic and Legal Perspectives of Regulation, Liability and Information Disclosure

Sasha Romanosky, Carnegie Mellon, United States of America, sromanos@andrew.cmu.edu, Alessandro Acquisti

We analyze personal data protection laws in the United States through the lenses of the economic theories of ex ante safety regulation, ex post liability and information disclosure. Specifically, we consider and contrast how legal and economic theories interpret privacy costs and the remedies to those costs and highlight conditions under which these regimes may become socially inefficient.

2 - Managing Interdependent Security Risks

Xia Zhao, Assistant Professor, University of North Carolina-Greensboro, Bryan 479, ISOM Dept, University of North Carolina-Greensboro, Greensboro, NC, 27402, United States of America, x_zhao3@uncg.edu, Ling Xue, Andrew Whinston

We examine how firms can address investment inefficiency caused by network externalities of information security investments using three risk management approaches-cyberinsurance(CI), Risk Pooling Arrangement(RPA), and Managed Security Service(MSS). We find the combination of CI and RPA can only be used to address investment inefficiency associated with negative externalities of security investments. With MSS, firms can endogenize both positive and negative externalities of security investments.

3 - Investors' Reactions to Information Security Incidents and Short-Term Profitable Investment Opportunities

Jackie Rees, Purdue University, United States of America, jrees@purdue.edu, Karthik Kannan, Ta-Wei Wang

This paper investigates investors' reactions to breach announcements. The results show that, from the sophisticated investors' perspective, security incidents do not affect a firm's future performance and the textual contents of news articles affect unsophisticated investors' reactions. Different perceptions among investors regarding security incidents provide profitable short-term investment opportunities

4 - Roles of Information Security Awareness and Perceived Fairness in Information Security

Hasan Cavusoglu, Assistant Professor, University of British Columbia, Sauder School of Business, Vancouver, BC, V6T0A2, Canada, Hasan.Cavusoglu@sauder.ubc.ca, Burcu Bulgurcu, Izak Benbasat

We investigate two factors that drive an employee to comply with requirements of the information security policy of her organization with regards to protecting information and technology resources: an employee's information security awareness (ISA) and her perceived fairness of the requirements of the ISP. Our results show that ISA and perceived fairness positively affect attitude, and in turn attitude positively affects intention to comply. ISA also has an indirect impact on attitude.

■ MB17

C-Room 28B, Upper Level

Information Systems II

Contributed Session

Chair: Elahe Javadi, PhD Student, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S Sixth ST, Champaign, IL, 61820, United States of America, ejavadi2@illinois.edu

1 - A Co-opetition Perspective on Firm Entry Strategy in Standard-setting Organizations

Juliana Tsai, Doctoral Program in Information Systems, Arizona State University, W. P. Carey School of Business, Tempe, AZ, 85287, United States of America, juliana.tsai@asu.edu, Robert Kauffman, Benjamin Shao

Co-opetition, a strategy of cooperation and competition, is observed in firms that join industry forums. We use event history analysis models to study the extent to which business strategies are characterized by co-opetition in firm entry timing in an SSO. We study a consortium that creates process standards and analyze 73 U.S. public firms over 20 years. Our results show that participation varies with firm heterogeneities and the intertemporal dynamics of firm valuations for SSO participation.

2 - An Electronic Market Framework for Applying Multi-agent to Support Collective Purchasing

Ma XuBu, The School of Management Xi'an Jiao Tong University, Xi'an Jiao Tong University, Xi'an, China, whuama@gmail.com, Guo Ju E, Wang Hua

This article builds a multi-agent based semi-automated electronic market framework supports collective purchasing. First analyses the overall structure and transaction process of this market. Second put forward the functions of the multi-agent. Third divided the negotiation process into two stages of negotiation among members and negotiation between brokers and sales, and adaptive-AHP is applied in the negotiation mechanism. Finally, through an example show the whole process of the transaction.

3 - An Empirical Analysis of Customer Service on the Internet

Sang Pil Han, Doctor, New York University, 44 West 4th Street, Room 8-178, Stern School of Business, New York City, NY, 10012, United States of America, sangpil78@gmail.com, Wenling Hsu, Ann Skudlark

This paper focuses on email customer service and examines how firms can improve customer satisfaction through effective email customer service operations. We build a hierarchical Bayesian modeling framework in which we estimate the impact of email customer service features on customer satisfaction. Results show that customer preferences are highly diverse. We find that customers who expressed negative emotion in emails they sent are highly responsive to service representatives response style.

4 - Investigation of Market Volatility Impact on Trading Strategy Performance Using Simulation

Chris Parker, PhD Candidate, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, cparker.phd2007@london.edu, Bruce Weber

We examine the impact of market volatility on trading strategy performance. To investigate this we adapt the classic approach of modeling the market using informed traders and noise traders. By simulating multiple informed and noise traders in an agent-based simulation, we can test for differences in market metrics for three configurations of four trading strategies in nine volatility levels. Our results indicate that the market volatility has an impact on trading strategy performance.

5 - Improving Quality in Computer-mediated Group Ideation: A Random Walk Model

Elahe Javadi, PhD Student, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S Sixth ST, Champaign, IL, 61820, United States of America, ejavadi2@illinois.edu, Judith Gebauer, Wai-Tat Fu

We develop a random walk model of idea quality in a computer-mediated group ideation environment. The model is composed of a drift and a variance function, which represent individual's learning and the inherent volatility of the idea quality respectively. The model provides an integrated explanation of the influence of interface attributes on idea quality. Our findings will provide guidelines for the design of user interfaces that facilitate group ideation success.

■ MB18

C-Room 28C, Upper Level

Markov Decision Processes in Healthcare

Sponsor: Computing Society
Sponsored Session

Chair: Nedialko Dimitrov, The University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, ned.dimitrov@gmail.com

1 - A Decision Process for Resolving Location Uncertainty in Laproscopic Surgery

Farhad Ghassemi, Center for Health Care Management, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, farhad.ghassemi@chcm.ubc.ca, Steven Shechter, Martin Puterman, Christopher Nguan

While an analysis of pre-operative data in laproscopic surgery may suggest possible locations of critical structures, there is still considerable uncertainty of their locations during the surgery. In this talk, we employ the theory of Markov decision processes to facilitate decision making in this type of surgery. We consider one and two-dimensional models of the problem, and provide analytical and numerical results on the structure of the optimal policies.

2 - Stabilizing Hospital Occupancy through Admission Control

Shervin Ahmadbeygi, University of Michigan-Ann Arbor, College of Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, shervin@umich.edu, Mark Van Oyen, Jonathan Helm

Variability in hospital occupancy negatively impacts the cost and quality of patient care delivery through increased congestions, emergency diversions, cancelations, radiology backlogs, overstaffing and understaffing. In this research we present a stylized Markov Decision Process model to analyze the relationship between hospital occupancy and admission decisions. Our goal is to understand how admission decisions when linked to inpatient census, can effectively reduce occupancy variations.

3 - Computing Interventions for Vector Borne Diseases

Nedialko Dimitrov, The University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, ned.dimitrov@gmail.com, David Morton, Sahotra Sarkar, Stephen Szymanski

We model geographic vector borne disease movement as a random walk that is informed by the underlying geographic area suitability for the disease vectors and reservoirs. We use Markov decision process design to compute disease intervention locations with the aim of preventing the disease from reaching critical, high-population areas. We illustrate our methods by computing Leishmaniasis intervention strategies in Texas, an area where Leishmaniasis has historically spread northward.

■ MB19

C-Room 28D, Upper Level

Innovations in Vehicle Routing Modeling

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu

1 - Strategic Thinking and Risk Taking in Route Choice: An Experimental Approach

Michael Razo, Research Assistant, University of Massachusetts Amherst, 141 Marston Hall, 130 Natural Resources Rd., Amherst, MA, 01003, United States of America, mike.razo@gmail.com, Song Gao

This research investigates route choice behavior in networks with risky travel times and real-time information. A study is conducted in which subjects use a PC-based interactive map to choose routes link-by-link in various scenarios. The results are analyzed to determine whether the subjects use strategies which account for en route information in route planning. Several forms of generalized route choice models are estimated and compared.

2 - A Prospect Theory Approach to Modeling Adaptive Route Choices in Risky Traffic Networks

Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu, Emma Frejinger, Moshe Ben-Akiva

We present an adaptive route choice model capturing travelers' strategic behavior in a stochastic network with traffic information, based on the cumulative prospect theory (CPT). It is estimated using synthetic data along with a model based on expected utility. The prediction results indicate large differences in path share predictions and demonstrate the flexibility of the CPT model to represent varying risk attitudes depending on the outcome probabilities.

3 - Online Sequential Routing with Link Failures

David Fajardo, University of Texas at Austin, Department of Civil Engineering, Earnest Cockrell Jr. Hall, 6.202, Austin, TX, 78705, United States of America, davidf@mail.utexas.edu, Travis Waller

We consider a routing problem in a network with link failures where the objective is to sequentially route vehicles in order to determine whether or not a path exists between a certain origin and destination, assuming a vehicle is no longer functional if it encounters a link failure. We propose a Dynamic Programming formulation, and develop bounding procedures for optimal routing schemes.

4 - A Link-based Day-to-day Traffic Dynamic Model

Xiaozheng He, University of Minnesota, 500 Pillsbury Dr. SE, 122 Civil Engineering Building, Minneapolis, MN, 55455, United States of America, hexxx069@umn.edu, Xiaolei Guo, Henry Liu

We propose a day-to-day traffic dynamic that directly deals with link flows, in contrast with traditional path-based models which are built upon path flows. A path flow non-uniqueness shortcoming inherent in all path-based models is identified. This shortcoming shows that different initial path flow patterns, although constituting the same link flow pattern, generally produce different day-to-day link flow evolutions. The proposed link-based dynamic avoids this shortcoming and its fixed point.

■ MB20

C-Room 28E, Upper Level

Containerized Freight Transportation

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Mark TurnquistProfessor, Cornell University, 309 Hollister Hall, Ithaca, NY, 14853, United States of America, mat14@cornell.edu

1 - The Effect of Oil Price on Containership Speed & Fleet Size

David Ronen, Professor, University of Missouri-St. Louis, College of Business Admin., 8001 Natural Brdg. Rd., St. Louis, MO, 63121, United States of America, david.ronen@UMSL.edu

Slow steaming may save a small fortune when bunker fuel prices rise. We analyze the tradeoff between bunker fuel price on the one hand and sailing speed and fleet size on the other hand. A simple procedure is proposed to determine the optimal speed and fleet size of container liners.

2 - Shared Stacking Policy for Stacking Export Containers at Container Yards

Amir Hossein Gharehgozli, PhD Candidate, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, AGharehgozli@rsm.nl, Rene De Koster, Jan Tijman Udding, Yugang Yu

Reshuffling is very costly and time consuming in retrieving containers. In order to minimize the number of reshufflings, this paper proposes a dynamic programming model to determine stacking positions of incoming containers. A shared stacking policy is applied, which allows containers of multiple ships to share a common stacking area. DP can only provide optimal solutions for small scale problems in a reasonable time. Using these solutions, we develop a heuristic to solve large scale ones.

3 - Easy or Hard? An Empirical Examination of Stacker Crane Problems With Implications for Solvability

F. Jordan Srour, PhD Candidate, Rotterdam School of Management, Erasmus University, Burg. Oudlaan 50, Rotterdam, 3062PA, Netherlands, JSrour@rsm.nl, Rob Zuidwijk, Steef van de Velde

Many real-world Stacker Crane Problem (SCP) instances, (i.e. truckload pick-up and delivery problems with a single vehicle), are quickly solved to optimality despite general membership of the SCP in the class of NP-hard problems. We ask the question: "From an empirical standpoint, what makes an SCP easier/harder than a general asymmetric traveling salesman problem?"

4 - Import/Export Container Flow Modeling and Disruption Analysis
Mark Turnquist, Professor, Cornell University, 309 Hollister Hall, Ithaca, NY, 14853, United States of America, mat14@cornell.edu, Julie Lloyd, Scott Ostrowski, Orr Bernstein, Linda Nozick, Carmen Rawls, Dean Jones, Chad Davis, Adam Turk, Brian Levine

We describe a global network model of container flows for U.S. imports and exports. The model includes 46 foreign countries, 14 major North American ports and 84 U.S. analysis zones. It allows estimates of flow diversions between U.S. ports as a result of implementation of security initiatives or occurrence of port disruptions. The model also estimates rail and truck flows within the U.S. and forms the basis for assessing economic costs of events that disrupt import/export flows.

■ MB21

C-Room 30B, Upper Level

Transportation Asset Management and Investment

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Srinivas Peeta, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, United States of America, peeta@purdue.edu

1 - Analysis of the Motorway Infrastructure Concession Using Performance Indicators
Mariana Rodgrigues Brochado, marianabrochado@gmail.com, Javier Faulin

This paper proposes a procedure for the assessment and prioritization of performance indicators of the motorway infrastructure concessionaries' activities in Brazil. A survey with experts was performed using the Quality Function Deployment-QFD. Thus, a quantitative analysis relates the user's required quality with the technical quality of the road, using a methodology of value theory. Likewise, monitoring activities were prioritized and the road performance control indicators defined.

2 - Optimal Private-Sector Investment on a General Road Network under Alternative Market Entry Regulations
Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu

This paper develops models of market entry, price, and capacity choices on a general network to analyze private toll roads for both regulatory and investment decision-making. Several market entry regulations on private toll roads, including free entry, revenue sharing, toll restrictions, and competitive bidding, are considered, and the resulting optimal private-sector investment decisions derived.

3 - Equilibrium Analysis of Interdependent Infrastructure Systems
Srinivas Peeta, Purdue University, 2700 Kent Avenue, Suite B100, West Lafayette, United States of America, peeta@purdue.edu, Pengcheng Zhang

There is an increasing need to capture interdependencies among infrastructure systems to address design, planning, and operational efficiencies. We propose a generalized framework to study this problem under an equilibrium setting by combining a multilayer network approach with a market-based economic approach. Numerical experiments are used to generate insights on the implications of interdependencies as well as the model capabilities.

4 - Parking Garage Infrastructure Problem: Optimizing for PHEVs V2G Operations
Seok Kim, Graduate Research Assistant, Texas A&M University, Department of Civil Engineering, College Station, TX, 77843, kimseoksaroi@tamu.edu, Ivan Damnjanovic

Plug-in Hybrid Electric Vehicles (PHEVs) are becoming increasing more popular. These vehicles can be connected to a power grid in order to charge or discharge the vehicle battery. In presence of V2G technologies, parking garage developers have an opportunity to gain revenue not only from the parking fees, but also from contracts with the aggregators in electricity markets. This study presents a model for determining optimal parking garage location and the incentive structure.

■ MB22

C-Room 30C, Upper Level

Transport Operations

Contributed Session

Chair: David Kim, School of MIME, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu

1 - Solving Hierarchical Problems via Multi-objective Optimization
Mihalis Golias, University of Memphis, 104 Engineering Science Bldg, Memphis, TN, 38152, United States of America, mihalisgolias@yahoo.com, Georgios K.D. Saharidis

Assignment problems appear frequently in different engineering fields like transportation engineering, electrical engineering, network optimization etc. These problems often have different and conflicting objectives that can be captured by multi-objective and hierarchical formulations of mathematical programs. In this paper we clarify the relation between bi-level and bi-objective problems applied in a group of assignment problems.

2 - Fleet Asset Utilization & Implications on Cost and Equipment Replacement
David Kim, School of MIME, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu, Tristan Wagner

The methods for assigning vehicles in a fleet to tasks will have implications on the overall cost of operating a fleet. We compare different strategies for assigning vehicles with respect to total cost. Data from actual fleets will be presented that demonstrates trends in vehicle utilization resulting from a common method of assigning vehicles to tasks. The implications on vehicle replacement analysis will also be presented.

■ MB23

C-Room 30D, Upper Level

DIME/PMESII Pt 3

Sponsor: Military Applications Society
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Modeling and Visualization in Maritime Piracy Networks
Philip Fellman, Professor, Southern New Hampshire University/Big Sky LLC, 2500 North River Road, Manchester, NH, 03106, United States of America, shirogitsune99@yahoo.com, Dinorah Frutos, Nathan Thanakijsombat, Pard Teekasap, Stan Renard

Maritime piracy has been on the rise for years and the distinction between terrorism and piracy has often been unclear. We investigate the period 1998-2007 using social network analysis and dynamic network analysis software modeling tools in order to obtain a more finely tuned data visualization and modeling of maritime piracy, particularly with respect to location and frequency.

2 - Human Domain Modeling in Support of Military Operations
Richard Pei, Chief, Modeling and Simulation, Army CERDEC I2WD, Director, I2WD, McAfee Center, Fort Monmouth, NJ, 07746, United States of America, Richard.Pei@us.army.mil, Gary Citrenbaum

US Army I2WD is establishing a testbed for vetting human domain models and their underpinning usage concepts. Progress will be reported on efforts to integrate PMESII and HSCB models and tools together within a robust modeling framework to form a HSCB - PMESII enabled modeling capability so that new Concept of Operations can be developed and executed for a variety of military operations at all echelons or command.

3 - Irregular Warfare Focused Intelligence, Surveillance, Reconnaissance, Analysis and Planning
Gary Citrenbaum, President /Chief Scientist, SoSACorp, 3877 Fairfax Ridge Rd Suite 201C, Fairfax, VA, 22030, United States of America, gcitrenbaum@sosacorp.com

In response to urgent requirements to improve support to IW and COIN Operations, DoD has begun developing new doctrine, TTPs, & tools. However, as we see it, the improvements being considered are only a necessary first step. The shortfall, as we see it, lies in our inability to effectively leverage: the data explosion, modern collection assets, and modern, albeit non-traditional models. In this paper we will discuss the shortfall & offer concrete recommendations on how to begin solving it.

■ MB24

C-Room 30E, Upper Level

Tutorial: Using DOE Methods for Efficient Simulation

Sponsor: Military Applications Society
Sponsored Session

Chair: Tom Donnelly, SAS Institute Inc., 27 Farmingdale Ln, Newark, DE, 19711-4392, United States of America, tom.donnelly@jmp.com

1 - Design of Experiments for Efficient Simulation

Tom Donnelly, SAS Institute Inc., 27 Farmingdale Ln, Newark, DE, 19711-4392, United States of America, tom.donnelly@jmp.com

Design of Experiments (DOE) methods for efficiently extracting the most useful information from simulations will be demonstrated. A sequential design approach will show how to run the fewest simulations needed to do sensitivity analysis or to develop a fast-running surrogate model. Solutions will include the application of both traditional DOE to discrete event and agent-based simulations and space-filling designs to more complex physics-based simulations using Computational Fluids Dynamics.

■ MB25

C-Room 31A, Upper Level

Industry Studies Association Joint Session: Creating a Forum for Industry Studies in Passenger Aviation

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

1 - Creating a Forum for Aviation Industry Studies

Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

In this session, we will discuss the growing field of Industry Studies and how hands-on observation and analysis of the airline industry can shape the research conducted by the OR community.

2 - How Does Information Sharing Impact ATFM Decisions?

Thomas Vossen, University of Colorado, 955 Regent Drive, Boulder, CO, 80309, United States of America, vossen@colorado.edu

The Collaborative Decision-Making paradigm has introduced a number of initiatives that emphasize information sharing and common situational awareness. We analyze how these initiatives can impact ATFM decisions, by considering airport acceptance rate planning during Ground Delay Programs. Using theoretical models that optimize airport acceptance rates given demand uncertainty, we evaluate whether the predicted rate changes that would occur with information sharing can be observed in practice.

3 - Dynamic and Static Robustness - Two Sides of the Same Coin?

John-Paul Clarke, Associate Professor, Georgia Institute of Technology, School of Aerospace Engineering, 270 Ferst Drive NW, Atlanta, GA, 30332, United States of America, johnpaul@gatech.edu

Recent studies have shown that more robust airline schedules can be developed by correlating block and ground times with expected delay in different phases of flight. However, the resulting schedules are often not amenable to aircraft and crew swaps, the most often used tactic for dealing with actual disruptions. I introduce the concepts of static and dynamic robustness within the context of airline scheduling and present a methodology for combining them to mitigate the effects of disruptions.

■ MB26

C-Room 31B, Upper Level

Edelman Finalists Reprise - I

Sponsor: CPMS, The Practice Section
Sponsored Session

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

1 - Decision Engineering at Intel Corporation (The 2009 INFORMS Prize Winner)

Karl Kempf, Intel Corporation, 5000 W. Chandler Blvd., MS-CH3-10, Chandler, AZ, 85226, United States of America, karl.g.kempf@intel.com

The 2009 INFORMS Prize was awarded to the Intel Decision Engineering Group. By employing an array of OR/MS disciplines, and a process to diffuse them, the Decision Engineering Group has impacted a vast and diverse set of Intel's functions including product design, demand forecasting, factory development, pricing structures, equipment and material acquisition, and production-inventory-logistics planning. These applications have contributed more than $4 billion in improved decision making.

2 - Zara Uses Operations Research to Reengineer its Global Distribution Process

Jeremie Gallien, MIT Sloan School of Management, 50 Memorial Drive, Cambridge, United States of America, jgallien@mit.edu, Javier Garcia, Jose Manuel Corredoira, Marcos Montes, Jose Antonio Ramos, Juan Correa, Felipe Caro

Overcoming significant technical and human difficulties, Zara recently deployed a new process relying extensively on sophisticated Operations Research models to determine every single shipment of inventory it sends from its two central warehouses to its 1500 stores worldwide. This new process has increased sales by an estimated 3-4%, corresponding to an estimated realized impact of approximately $233M and $353M in additional revenues for 2007 and 2008, respectively.

■ MB27

C-Room 31C, Upper Level

Advances in Monte Carlo Methods and Applications to Finance and Long Range Dependence

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Jose Blanchet, Columbia University, Mudd Building 340, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Monte Carlo Methods for Ill-posed Inverse Problems

Rama Cont, Associate Professor, Columbia University, 500 W. 120th Street, New York, NY, 10027, Rama.Cont@columbia.edu

Ill-posed inverse problems arising in parameter estimation from noisy observations are usually tackled with deterministic optimization methods, ignoring non-uniqueness of solutions which reflects parameter uncertainty. We present a Monte Carlo method which generates a random sample of solutions for a large class of nonlinear ill-posed inverse problems. We exhibit conditions under which the algorithm generates an IID sample of solutions, which can be used to analyze parameter uncertainty.

2 - Strongly Efficient Simulation of Light Tailed Sums

Kevin Leder, kevinleder@gmail.com

We estimate the probability that the average of a large number of light-tailed mean zero i.i.d. random vectors does not lie in a closed convex set that does not contain the origin. We provide a state-dependent importance sampling that has bounded coefficient of variation. Our change of measure is obtained by computing the optimal tilting at each step, which corresponds to the solution of the Isaacs equation studied recently by Dupuis and Wang (2004).

3 - Efficient Large Buffer Estimation of General Gaussian Queues

Jose Blanchet, Columbia University, Mudd Building 340, New York, NY, United States of America, jose.blanchet@columbia.edu

We consider estimating the tail of the maximum of a Gaussian process with negative drift via simulation. We discuss an algorithm that requires a polynomial (in the tail parameter) number of function evaluations to estimate such tail probability within a given prescribed relative accuracy. Our procedure is very simple and its performance is theoretically guaranteed for arbitrary dependence structures.

■ MB28

H-Room 500, Fifth Floor

Decentralized Pricing and Alliances in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Gustavo Vulcano, Assistant Professor, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu

1 - Airline Alliance Collaboration and Operation
Xing Hu, PhD Candidate, New York University, 44 West 4th St, New York, NY, 10012, United States of America, xhu@stern.nyu.edu, Rene Caldentey, Gustavo Vulcano

We investigate contractual agreements between multiple airlines operating within a network alliance. We study contracts that specify how revenue should be split among the carriers. We propose a two-step hierarchical approach. First, we formulate a static problem in which airlines select partitioned allocations and show that a simple transfer price mechanism achieves first best. Then, we study the dynamic problem and prove that the static transfer prices are asymptotically optimal.

2 - Airline Alliance Revenue Management Using a Deterministic LP Formulation
Sandra Transchel, Smeal College of Business, 461 Business Building, University Park, PA, 16802, United States of America, sxt37@psu.edu, Robert Shumsky

We examine the airline alliance revenue management problem using a formulation based upon the deterministic linear programming model for network revenue management. We identify transfer prices for interline itineraries that are system-optimal. We also explore the airlines' equilibrium policies and compare the overall performance to an alliance with centralized control.

3 - Designing Fair Allocations for Carrier Alliances
Lori Houghtalen, Assistant Professor of Operations Research, Babson College, Division of Mathematics and Science, Babson Park, MA, 02457, United States of America, lhoughtalen@babson.edu, Ozlem Ergun, Joel Sokol

Given a mechanism that encourages alliance-optimal behavior from carriers, we focus on directing the mechanism toward resource prices that lead to fair allocation of revenue. Fairness measures explored include equal distribution of benefit and measures based on the value of cargo and capacity carriers contribute. Equal benefit distribution leads to more alliance revenue overall, but the mechanism is able to achieve allocations more precisely when fairness is measured by the value of a carrier.

4 - Decentralized Control of a Stochastic Pricing-service System
Andrew Lim, Associate Professor, University of California (Berkeley), IEOR Department, 4177 Etcheverry Hall, University of California, Berkeley, CA, 94720-1777, United States of America, lim@ieor.berkeley.edu, Peng Li, J. George Shanthikumar

We formulate a stochastic system where arrivals and service rate are controlled. We show how to decouple this system into a single period revenue management problem and a service rate control problem. We show how to centralized optimal can be computed without pricing and service agents sharing demand rate and objective function information.

■ MB29

H-Room 501, Fifth Floor

Issues in Generation Expansion Planning and Environmental Policy Modeling

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

Chair: Vishnu Nanduri, Assistant Professor, Department of Industrial & Manufacturing Engineering, University of Wisconsin Milwaukee, 3200 N Cramer Street, Milwaukee, WI, 53211, United States of America, nvishnuteja@gmail.com

1 - Generation Capacity Expansion in Restructured Power Markets under a CO2 Cap-and-Trade Program
Patricio Rocha, University of South Florida, Department of Industrial Eng, Tampa, United States of America, procha@mail.usf.edu, Vishnu Nanduri, Tapas Das

Power generators face the challenge of determining where, when and what type of power plant to build to satisfy an increasing demand. The potential implementation of a CO2 cap-and-trade program is likely to compound this challenge. In this paper, we develop a model to obtain generation capacity expansion plans in restructured markets under different CO2 cap-and-trade scenarios. A real-life application to the Illinois Electricity Market is presented.

2 - Renewable Subsidy Policy Design for Generation Expansion
Lizhi Wang, Assistant Professor, Iowa State University, Industrial and Manufacturing Systems Eng, Ames, IA, 50014, United States of America, lzwang@iastate.edu

We use an inverse optimization approach to design the most cost effective subsidy policy to promote renewable energy in a generation expansion planning problem. The subsidy policy is designed to achieve (1) sufficient generation to accommodate load increase, (2) an increased renewable energy portfolio, and (3) lower and more stable electricity prices.

3 - Renewable Energy in Generation Expansion Planning Models
Jianhui Wang, Computational Engineer - Energy Systems, Argonne National Laboratory, 9700 S. Cass Ave, Bldg. 900, Argonne, IL, 60439, United States of America, jianhui.wang@anl.gov, Audun Botterud, Vladimir Koritarov, Thomas D. Veselka

Traditionally, renewable energy like wind and solar power has received limited attention in generation expansion planning. However, investments in these technologies are rapidly increasing due to policies aiming at reducing carbon emissions and increasing the share of renewable energy. We discuss how the uncertainty and variability in renewable energy can be represented in generation expansion planning, with focus on the rapid expansion of wind power.

4 - The Ambiguous Effect of Contracts on Competition and Prices in Restructured Electricity Markets
Fred Murphy, Professor, Temple University, Philadelphia, PA, 19122, United States of America, fmurphy@temple.edu, Yves Smeers

We construct a stylized model of contracts where two firms, each specializing in some technology, invest in a first stage, contract part of their production in the second stage and sell the rest in the spot market in the third stage. We find both the incentive to contract to foreclose the market and a reduction in pricing power. The outcome of including contracts can lead to either increases or decreases in capacity and peak prices and contracts are not a guaranteed solution to market power.

■ MB30

H-Room 502, Fifth Floor

Forestry IV: Urban Forest Management

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

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Urban Trees: The Antidote to Broken Windows?
Geoffrey Donovan, U.S. Forest Service, Pacific Northwest Research Station, Portland, OR, United States of America, gdonovan@fs.fed.us, Jeffrey Prestemon

Research has shown that urban trees provide a range of benefits including reducing heating and cooling costs and increasing property values. Less attention has been focused on the potential of urban trees to affect crime occurrence. We present evidence that non view-obstructing trees reduce crime, because they signal that a house is well cared for. This is consistent with the broken-window hypothesis, which suggests that if a neighborhood does not appear cared for, then it will attract crime.

2 - Simulating the Energy Savings From Shade Tree Plantings
David Butry, National Institute of Standards and Technology, Gaithersburg, MD, United States of America, david.butry@nist.gov, Geoffrey Donovan, Joshua Kneifel

While planting shade trees reduces residential cooling costs, it may not be cost-effective when compared to other energy saving measures. Using EnergyPlus, we compare the residential energy savings produced by urban shade tree plantings with those more traditional methods of achieving energy efficiency (e.g., windows, insulation, HVAC replacement). We find the savings produced by shade trees to be substantial, with optimal tree placement depending on tree characteristics and house orientation.

3 - Cost of Potential Emerald Ash Borer Damage in U.S. Communities, 2009-2019
Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us, Andrew Liebhold, Rodrigo Mercader, Nathan Siegert, Deborah McCullough, Kent Kovacs

Emerald ash borer, a beetle native to Asia, was discovered near Detroit in 2002 and by 2009 had been found in 10 other states. EAB is a highly invasive forest pest that has the potential to spread and kill native ash trees throughout the U.S. Using a simulation model of EAB spread, we estimate the impacts of EAB in urban areas in a 25-state region. We predict that 17 million ash trees will be treated or removed over the next decade with discounted cost of $9.9 billion.

■ MB31

H-Room 503, Fifth Floor

Learning/Robust Methods for Pricing and Capacity Control

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Tatsiana Levina, Queens School of Business, 143 Union Street, Kingston, Canada, tlevin@business.queensu.ca

1 - Data-driven Learning for a Class of Stochastic Optimization Problems

Soonhui Lee, PhD Candidate, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, soonhui@u.northwestern.edu, J. George Shanthikumar, Tito Homem-de-Mello

We discuss stochastic optimization problems that involve unknown dependencies between the decision and the random variables in the model. An important case occurs in the setting where demand depends on the inventory controls such as order quantities. We study a data-driven learning algorithm that simultaneously learns the objective function from previous observations and optimizes the obtained estimates. We present examples and discuss convergence properties of the algorithm.

2 - Risk Premiums in the Newsvendor Model

Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States of America, guillaume.roels@anderson.ucla.edu

In this talk, we quantify the value of information associated with demand uncertainty in the price-setting newsvendor model. We present a unifying framework that generalizes the additive and the multiplicative demand models and we quantify the worst-case magnitude of the price risk premiums resulting from demand uncertainty.

3 - Symbolic Perseus: a Generic POMDP Algorithm with Application to Dynamic Pricing with Demand Learning

Pascal Poupart, Associate Professor, School of Computer Science, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, ppoupart@cs.uwaterloo.ca

Partially Observable Markov Decision Processes (POMDPs) provide a flexible framework for dynamic pricing with demand learning. Given the wide range of applications, there is a need for scalable algorithms that can optimize the policies of arbitrary POMDPs. I will describe Symbolic Perseus, a publicly available POMDP package, that has been used to optimize discrete factored POMDPs with millions of states. The algorithm will be illustrated with various applications including dynamic pricing.

4 - Aggregating Algorithm for Pricing and Capacity Planning under Uncertain Demand

Tatsiana Levina, Queens School of Business, 143 Union Street, Kingston, Canada, tlevin@business.queensu.ca, Yuri Levin, Mikhail Nediak, Jeff McGill, Vladimir Vovk

We study the problem of pricing and stocking of perishable items when demand and the reservation price distributions are unknown. The company learns consumer demand through successive observations over consecutive planning horizons, views the problem as a game against nature and applies Aggregating Algorithm to find the policies which are asymptotically optimal in the long run. The proposed methodology is general and independent of the form of the distributions.

■ MB32

H-Room 504, Fifth Level

Stochastics in Finance

Cluster: Financial Engineering
Invited Session

Chair: Ruth WilliamsProfessor, University of California, San Diego, Dept of Mathematics, 9500 Gilman Drive, La Jolla, CA, 92093-0112, United States of America, williams@stochastic.ucsd.edu

1 - A Fast Mean-reverting Correction to Heston's Stochastic Volatility Model

Matthew Lorig, Ph.D. Student, UCSB, Statistics and Applied Probability, South Hall, Santa Barbara, CA, 93, United States of America, mattlorig@gmail.com, Jean-Pierre Fouque

We propose a multi-scale stochastic volatility model in which a fast mean-reverting factor of volatility is built on top of the Heston stochastic volatility model. A singular pertubative expansion is then used to obtain an approximation for European option prices. Numerical difficulties are discussed, and techniques for avoiding these difficulties are provided. Our results are illustrated numerically and with option data.

2 - Correlated Intensity, Counter Party Risks, and Dependent Mortalities

Jin Ma, Professor, University of Southern California, Department of Mathematics, 3620 S. Vermont Ave. KAP 108, Los Angeles, CA, 90089, United States of America, jinma@usc.edu

We propose an intensity-based approach for studying the correlated default probability. Based on an idea of Collins-Dufresne et al., we derive a representation theorem for joint survival probability. The representation theorem works particularly well for certain counter-party risk models and dependent mortality models for married couples. Other topics include the study of first and last to default probabilities in a multi-firm setting, in particular the phenomenon of ``flight to quality".

3 - Connecting Singular Controls and Switching Controls, with Applications to Irreversible Investment

Xin Guo, Associate Professor, UC at Berkeley, Berkeley, United States of America, xinguo@newton.berkeley.edu

It was well known that a certain class of singular control problems is connected to optimal stopping problems. In this talk, we present a new theoretical connection between singular control of finite variation and optimal switching problems. This correspondence provides a novel method for solving explicitly multi-dimensional singular control problems, and links singular controls and Dynkin games through sequential optimal stopping. This is a joint work with P. Tomecek, JP Morgan.

4 - Credit Risk Modeling with Misreporting and Incomplete Information

Agostino Capponi, PhD, California Institute of Technology, Paadena, CA, 91125, acapponi@caltech.edu, Jaksa Cvitanic

We propose a structural model for the valuation of defaultable securities of a firm which models the effect of deliberate misreporting done by insiders in the firm and unobserved by others. We derive formulas for corporate securities and default measures under the proposed credit risk framework. We propose a novel estimation approach to structural model estimation which accounts for noisy observed asset values and apply it to the concrete case of Parmalat.

■ MB33

H-Room 505, Fifth Floor

Retail Supply Chain Management

Cluster: Economic Models in Operations Management
Invited Session

Chair: Naren Agrawal, Santa Clara University, The Leavey School of Business, 500 El Camino Real, Santa Clara, CA, 95053, NAgrawal@scu.edu

1 - Price Markdown Optimization for a Fast-Fashion Retail Network

Felipe Caro, Assistant Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, fcaro@anderson.ucla.edu, Jeremie Gallien

In collaboration with Spanish retailer Zara, we address the problem of deciding the price markdowns during clearance sales. We approached the pricing problem by formulating two models, one to forecast demand, and the other to optimize the markdown decisions with a finite horizon in mind. We describe the results of a controlled field experiment conducted in all Zara stores in Belgium and Ireland during the winter clearance sales of 2008/09 in order to test the optimization-based pricing model.

2 - Empirical Study of Retail Execution

Nicole DeHoratius, University of Portland Pamplin School of Business, Zaragoza Logistics Center, Portland, United States of America, dehorati@up.edu, Marshall Fisher, Serguei Netessine

We describe research with a fast food restaurant chain that uses perating data, customer satisfaction survey results and in stock mystery shopping to identify drivers of sales and satisfaction. Particular attention is paid to the design of the restaurant process. This is part of a larger project with a number of retailers that aims to identify store operating policies that result in outstanding store execution, customer experience and financial performance.

3 - The Effect of Waiting Time on Customer Purchases: An Empirical Study

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

This paper studies empirically how customer delays in a supermarket affect customer purchases. We collected data on queue lenghts using videocameras and image recognition. These data were matched with point-of-sale data to estimate the effect of expected delays on sales. We also provide some insights on how these results can be used to optimize staffing decisions.

4 - Optimizing Prepacks for Retail Supply Chains
Stephen Smith, Professor, Santa Clara University, Lucas Hall 216H, 500 El Camino Real, Santa Clara, CA, 95053-0382, United States of America, Ssmith@scu.edu

Retail supply chain managers frequently bundle several units of the same item, or combinations of multiple items, into various "prepack" to reduce shipping and handling costs. The paper discusses heuristics and formulates a mixed integer LP for designing an optimal set of prepacks for periodic replenishments with discrete demands. Illustrative computational results are presented.

■ MB34

H-Room 520, Fifth Floor

Joint Session OR-Societal Impact/TSL: Logistics in Large-Scale Disaster

Cluster: OR/MS with Societal/ Humanitarian Impact & Transportation Science and Logistics
Invited Session

Chair: Elise Miller-Hooks, Associate Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, elisemh@umd.edu

1 - A Dynamic Relief Demand Forecast Model for Emergency Logistics Operations in Large-Scale Disasters
Jiuh-Biing Sheu, Professor and Director, National Chiao Tung University, 4F,no.114,Sec.1,Chung Hsiao W. Road, Taipei, 10012, Taiwan - ROC, jbsheu@mail.nctu.edu.tw

This paper presents a dynamic relief demand forecast model which involves three recursive mechanisms for emergency logistics operations under large-scale disasters. The proposed methodology utilizes the techniques of data fusion, fuzzy-clustering, and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). The results of numerical studies with simulation data indicate the applicability of the proposed method and its potential advantages.

2 - Optimal Ordering and Issuing Policies for Perishable Inventory System with Minimum Volume Constraint
Yen-Ming Lee, University of Southern California, 3715 McClintock Ave, GER 240, Department of Industrial & Systems Engineerin, Los Angeles, 90089-0193, United States of America, yenmingl@usc.edu, Shi Mu, Zhihong Shen, Maged Dessouky

SNS is part of the federal response to a large-scale emergency in the United States. The SNS is currently divided into "Push Packages" directly managed by the government, which constitute about 20%, with the rest as VMIs. We present perishable inventory system that enables the VMI suppliers to meet their minimum inventory requirement while maximizing their profit.

3 - Inventory Policies for Humanitarian Aid During Hurricanes
Laura Consuelos Salas, Research Assistant, ITESM Campus Toluca, Eduardo Monroy # 2000, San Antonio Buenavista, Toluca, Estado de México, 50110, Mexico, lconsuel@asu.edu, Muhong Zhang, Manuel Robles Cardenas

The work includes a methodology to calculate the demand for shelters in case of hurricane wind impact. It is based in physical vulnerability of houses and the time to stay in shelter. The MIP to determine the inventory policy that best satisfies that demand, is based in the newsboy model and transforms it to a deterministic problem using conditional expectation.

4 - Managing Supply Chains in Times of Crisis: A Review of Literature and Insights
Malini Natarajarathinam, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, malini@entc.tamu.edu, Ismail Capar, Arunachalam Narayanan

The objectives of this study are to provide a framework for classifying supply chain management literature in crisis management and to identify current and future research directions in this field. In addition, this paper will not only be a resource to academicians but also to practitioners who are looking for best practices in academic literature for managing disruptions in supply chains.

■ MB35

H-Sapphire A, Fourth Floor

Patient Management - Scheduling II

Sponsor: Health Applications
Sponsored Session

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

1 - A Two-phase Multiobjective Approach for Operating Room Planning and Scheduling Problem
Qing Li, PhD Student, Arizona State University, ISOE Department, P.O. Box 875906, Tempe, AZ, 85287-5906, United States of America, qli30@asu.edu, John Fowler

In this study, we develop an approach for cyclic block scheduling as well as day-to-day patient scheduling in operating rooms (OR), with the objectives of reducing staff overtime, idle time and patient waiting time. The problem is formulated in mixed integer programming and solved with CPLEX. A Random Keys Genetic Algorithm is used in patient sequencing to find the Pareto optimal sequence on the day of surgery.

2 - Approximate Dynamic Programming (ADP) for Resource-constrained Project Scheduling Problems
Yasin Gocgun, Doctoral Student, Industrial and Systems Engineering, University of Washington, Box 352650, Seattle, WA, 98105, United States of America, gocgun@u.washington.edu, Archis Ghate

We discuss models and algorithms for a class of stochastic, dynamic, resource-constrained scheduling problems. These problems can be formulated as infinite horizon Markov Decision Processes (MDPs). We approximately solve these MDP formulations using mathematical programming-based ADP techniques and compare their performance with heuristic policies. We also present applications from healthcare focusing on multi-category patient scheduling problems in an urban, diagnostic facility.

■ MB36

H-Sapphire B, Fourth Floor

2009 Pierskalla Competition Papers I

Sponsor: Health Applications
Sponsored Session

Chair: Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

1 - At What Lipid-ratios Should a Patient with Type 2 Diabetes Initiate Statins?
Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Nilay Shah, Steven Smith, Andrew Schaefer, Brian Denton

Lipid abnormalities elevate the risks of coronary heart disease (CHD) and stroke for patients with Type 2 diabetes and can be treated by statins with adverse side effects. We formulate the optimal timing of statin initiation problem as an infinite-horizon Markov decision process and explore several structural properties of the resulting treatment policies. We analyze the sensitivity of these policies with respect to varying risk factors and present computational results based on clinical data.

2 - The Benefit of Pooling Operating Rooms under Uncertainty
Sakine Batun, University of Pittsburgh, Pittsburgh, PA, 15260, sab79@pitt.edu, Andrew Schaefer, Todd R. Huschka, Brian Denton

We study the problem of scheduling surgeries with uncertain durations in a multiple operating room (OR) environment. We formulate the problem as a two-stage stochastic mixed integer program (SMIP) with the objective of minimizing total expected operating cost. We analyze structural properties of our model and propose a way of improving the existing solution procedures by adding valid inequalities to the formulation. We perform computational experiments based on real data.

3 - A Broader View of Designing the Liver Allocation System
Fatih Safa Erenay, University of Wisconsin Madison, 501 N Midvale Blvd Apt C, Madison, WI, 53705, United States of America, erenay@wisc.edu, Adnan Said, Mustafa Akan, Baris Ata, Oguzhan Alagoz

We develop a more efficient liver allocation system using a fluid model that minimizes a weighted sum of total quality adjusted life years and number of patient deaths while waiting for transplant. Our model considers the disease evolution as well as patient preferences. The proposed system allocates the livers to the patients who have the highest marginal benefit from transplant. We also simulate the current and proposed liver allocation systems using clinical data for comparison.

4 - The Search for Compatible Kidneys for Transplantation - A Handy Research and Decision Aid
Israel David, Professor, Ben-Gurion University, 14/38 Rahavat-Ilan Street, Givat-Shmuel, Israel, idavid@bgu.ac.il

We study the prospects of patients for kidney transplant and their optimal acceptance-rejection policy for varying-quality tissue matching. We present a computational tool to calculate the probabilities of present-day relevant HLA

mismatches, and the optimal policy in terms of critical times. The accompanied Excel software may serve both the surgeon and the organizer of a donation program. Its use sheds light on debated issues such as race discrimination in unrelated-donor organ transplantation.

■ MB37

H-Sapphire C, Fourth Floor

Contracts and Incentives in Supply Chains

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, Terman Enineering Center, Room 305, Stanford, CA, 94305, United States of America, ferhun@stanford.edu

1 - Optimal Pricing for Platform Products with Service Subscription
Hugo Mora, PhD Student, Stanford University, 344 Olmsted Rd, Apt 144, Stanford, 94305, United States of America, hrmora@stanford.edu, Juan Carlos Ferrer

We study the pricing decision of a firm that provides a subscription to a bundle consisting of a platform product and its associated service. The pricing policy consists of: the product price in the first period and the per-period subscription price. We show that the optimal product price is increasing in the product cost. The optimal subscription price depends on the service cost, but is independent of the product price and cost.

2 - A Dual-source Tool Capacity Expansion Problem with Reservation and Demand Forecast Updates
Chen Peng, PhD Candidate, Stanford University, Terman Engineering Center, RM 377, 380 Panama Way, Stanford, CA, 94305, United States of America, chenpeng@stanford.edu, Feryal Erhun

We study a dual-source tool capacity expansion problem with consecutive supply lead times under demand forecast updates. We show that fast orders follow a state-dependent base-stock policy. However, different from the inventory results, the slow orders do not necessarily have a base-stock policy, which shows that tool capacity expansion problem is more complex than its inventory counterpart. We characterize the conditions under which dual sourcing is beneficial to the buyer.

3 - The Impact of Environmental Regulations on Global vs. Local Product Sourcing Decisions
Daniel Greenia, Stanford, 375 Terman Hall, Stanford, CA, 94305, United States of America, dgreenia@stanford.edu, Dariush Rafinejad

We create a dynamic economic model of an industry that sources from either an environmentally unregulated, low cost region or a regulated, expensive region. Unlike traditional supply chain models, we explicitly account for environmental degradation with decreased labor productivity and by imposing increasingly strict regulations as pollution accumulates. Within this framework we study the impact of environmental regulations on the industry's financial performance, in addition to public health.

■ MB38

H-Sapphire D, Fourth Floor

Recent Advances in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Saibal Ray, Associate Professor, Desautels Fac of Mgmt, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, saibal.ray@mcgill.ca

Co-Chair: Tim Huh, Columbia University, 500 West 120th St, New York, United States of America, th2113@columbia.edu

1 - Lost-sales Inventory Models with Batch Ordering and Handling Costs
Jan Fransoo, Professor, Eindhoven University of Technology, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, J.C.Fransoo@tue.nl, Alina Curseu, Tom Van Woensel, Nesim Erkip

We consider the inventory control of a single item facing stochastic demand under periodical review, a fixed batch size, and lost sales. The replenishment cost include a fixed, as well as a linear component, depending on the number of batches and the number of units in the order. This structure captures the shelf-stacking costs in retail stores and allows economies of scale. We analyze the structure of the optimal policy, provide a numerical analysis, and introduce an effective heuristic.

2 - How Good Are (s,S) and (r,nQ) Policies in Two-Stage Serial Supply Chains?
Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. Geroge Street, Toronto, ON, M5S3E6, Canada, ming.hu@rotman.utoronto.ca, Lifeng Chen

We consider the classical two-stage serial supply chain with Poisson demand, fixed ordering costs and fixed transportation lead times. We show that there exist (s,S) and (r,nQ) policies whose long-run average costs are less than 2.25 times the optimal cost. We further show that these policies are asymptotically optimal as the ratio, between the optimal ordering quantities for the downstream and upstream stage when the system is relaxed to two single-stage problems, decreases to zero.

3 - Inventory Control with Outsourced Logistics
Osman Engin Alper, University of California, Berkeley, IEOR Department, Berkeley, United States of America, engin@ieor.berkeley.edu, Hyun-soo Ahn, Phil Kaminsky

As logistics outsourcing becomes more prevalent, managers need efficient strategies for managing inventory in the presence of a wide variety of different logistics contracts and strategies. Motivated by this, we analyze inventory control problems in systems with different logistics outsourcing strategies, characterize optimal policies, provide computational results, and summarize practical implications.

4 - Optimal Lot-sizing Policy For a Warm/Cold Process With Stochastic Demand and Lost Sale
Yi Yang, PhD Student, Chinese Univ of HK, PGH 2, The Chinses University of HongKong, HK, Hong Kong - PRC, yangyi@se.cuhk.edu.hk, Youhua Chen

We analyze a periodic-review production-inventory system in which at the beginning of each period, the process is in one of the two states: warm and cold, which depend on the production quantity of the previous period. Beginning with a warm (cold) state, production in the current period will incur no fixed (a fixed) setup cost. We establish theoretical results on the structure of the optimal production/inventory policy and propose an efficient heuristic policy.

■ MB39

H-Sapphire E, Fourth Floor

Sustainable Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

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

Co-Chair: Deishin Lee, Professor, HBS, Soldier's Field Rd, Morgan 415, Boston, MA, 02163, United States of America, dlee@hbs.edu

1 - Is Leasing Greener Than Selling?
Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, 30308, United States of America, vishal.agrawal@mgt.gatech.edu, Mark Ferguson, Beril Toktay, Valerie Thomas

There are claims that leasing is environmentally superior as a firm retains ownership of the off-lease units, it has an incentive to remarket the products, resulting in a lower production and disposal volume. However, it may be worse since the firm may prematurely dispose them to avoid cannibalization. In this paper, we analytically investigate if either leasing or selling can be both more profitable and have a lower environmental impact.

2 - The ESCO Problem under Uncertainty
Paul Kleindorfer, Professor, INSEAD, Blvd de Constance, Fontainebleau, 77305, France, Paul.Kleindorfer@INSEAD.edu, Sam Aflaki

An Energy Service Company (ESCO) implements energy efficiency projects for customers, which generates positive cash flows from the energy and carbon savings resulting from the project. For ESCO-type projects, we characterize Pareto efficient contracts having the following structure: upfront investment shares, ex-post profit shares and an ex-ante guarantee by the ESCO of savings for the customer. A case study from the pharmaceutical industry is used to illustrate the concepts and results.

3 - CO2 Emission Regulations and Electricity Prices: The Case of Coal-Fired Power Plants

Ozge Islegen, PhD Candidate, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States of America, oislegen@stanford.edu, Stefan Reichelstein

This study projects the changes in electricity prices if coal-fired power plants are regulated for their CO2 emissions. We focus on carbon capture and storage (CCS) technology that new power plants may adopt either because of a mandate or because the market price of CO2 emission permits is sufficiently high. We forecast the resulting changes in wholesale electricity prices and identify the break-even price of CO2 emission permits that makes the adoption of CCS technology economically attractive.

4 - Optimization of a Waste-to-Energy Operation

Deishin Lee, Professor, HBS, Soldier's Field Rd, Morgan 415, Boston, MA, 02163, United States of America, dlee@hbs.edu, Mustafa Tongarlak, Baris Ata

We study a firm that converts organic waste into energy using an anaerobic digestion process. We derive the profit-maximizing operational and pricing strategies for the firm. Given the operational model, we consider how different regulatory mechanisms can affect the strategy of the firm and the associated environmental implications.

■ MB40

H-Sapphire H, Fourth Floor

Financial Optimization, Account Management and Retail Credit Risk Management

Sponsor: Financial Services
Sponsored Session

Chair: Adrian Becker, MIT Operations Research Center, 77 Massachusetts Ave, Bldg E40-135, Cambridge, MA, 02139, United States of America, adrianbb@mit.edu

1 - Optimal Spending Patterns and Asset Allocation for Endowments, Foundations and Individuals

Chaithanya Bandi, Graduate Student, MIT, 550 Memorial Drive, Apt:10D-2, Cambridge, MA, 02139, United States of America, cbandi@mit.edu, Dimitris Bertsimas

We propose the application of Stochastic Dynamic Programming(SDP) and Robust Optimization methodologies to obtain optimal spending and investing policies in conjunction with eachother. We present tractable approaches to capture different levels of risk-aversion and different priorities of a manager. The policies obtained are compared with policies used presently and significant improvements are observed.

2 - Voice and Conscience for Optimization in Financial Planning

Adrian Becker, MIT Operations Research Center, 77 Massachusetts Ave, Bldg E40-135, Cambridge, MA, 02139, United States of America, adrianbb@mit.edu, Dimitris Bertsimas

We discuss two product additions developed for the Ameriprise Lifetime Optimizer. Voice translates proofs of local optimality into natural language giving intution as to why a client should adopt the proposed solution. Conscience identifies instances where model simplifications introduced for tractability yield a mathematically optimal solution which would perform sub-optimally when exposed to real-world dynamics. Cutting planes are then added to the underlying MIP to avoid this situation.

3 - Modeling the Credit Risk of RMBS; Comparison of Models

Lyn Thomas, Professor, University of Southampton, School of Management, University of Southampton, Southampton, So17 1BJ, United Kingdom, L.Thomas@soton.ac.uk

One cause of the credit crunch, according to the Securities and Exchange Commission was the inability of the rating agency models to correctly assess the credit risk of residential backed mortgage. This is partly because models based on corporate credit risk were used. This talk compares the different models based on consumers' behavioural scores used to estimate the credit risk of portfolios of consumer loans and suggests how these deal with difficulties identified in existing models.

4 - Integrating Loss Mitigation Decisioning Into Distressed Mortgage Valuation

Jim Bander, VP, Solution Management & Research, Response Analytics, Inc., 7426 E Stetson Dr., Suite 120, Scottsdale, AZ, 85251, United States of America, Jim.Bander@gmail.com

Investors in portfolios of distressed mortgages have to determine the portfolio value. We describe a methodology for doing so while evaluating every loan in the portfolio under each of several possible loss mitigation treatments, and determining an optimal loss mitigation policy subject to treatment eligibility and capacity constraints.

■ MB41

H-Sapphire L, Fourth Floor

JFIG Paper Competition II

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Ananth Iyer, Purdue University, aiyer@purdue.edu

1 - Quality Speed Conundrum: Trade-offs in Customer-Intensive Services

Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu

We model services where the expected service quality changes with service speed. Increasing the service rate reduces the waiting costs, but also reduces the expected service quality. An arriving customer decides whether to join a service based on its value, speed of service and his expected waiting costs. In equilibrium, when a service is more customer-intensive, the service provider chooses to slow down. We find that firms select partial coverage of the market, and charge higher prices in competition.

2 - Revenue and Cost Management for Remanufactured Products

Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, aovchinnikov@darden.virginia.edu

I present a model of firm's remanufacturing operations and a behavioral study that estimates its key element - a function that describes the fraction of consumers who switch from new to refurbished product. The behavioral study shows that this function has an inverted-U shape and hence cannot be modeled using the popular WTP-based approach. I then solve the model for both the inverted-U and WTP-based behaviors and comment on how firm's policy changes.

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

Vivek Farias, Assistant Professor, MIT Sloan School, E53-317, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, vivekf@mit.edu, Denis Saure, Gabriel Weintraub

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

■ MB42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice

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

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

1 - Approximate Dynamic Programming Captures Fleet Operations for Schneider National

Hugo Simao, Research Staff, Princeton University - CASTLE Lab, Sherrerd Hall 112, Princeton, NJ, 08544, United States of America, hpsimao@princeton.edu, John Nienow, Abraham George, Warren Powell, Jeff Day, Ted Gifford

Schneider National needed a model that would replicate the behavior of their team of dispatchers. We used the modeling and algorithmic framework of approximate dynamic programming to optimize the movements of 6,000 drivers, each described by a 15 dimensional attribute vector, over a month. The model closely replicates historical performance, and also produces accurate estimates of the marginal value of each of 500 types of drivers. Numerous projects have produced millions in savings.

2 - A Queuing Model-Based System for Semiconductor Production Planning at IBM

Horst Zisgen, IBM Deutschland Research and Development GmbH, Hechtsheimer Strasse 2, Mainz, 55131, Germany, horst_zisgen@de.ibm.com, Steven M. Brown, Ingo Meents, Thomas Hanschke, Benjamin R. Wheeler

This paper presents IBM's Enterprise Production planning Optimization System (EPOS). EPOS uses a unique queuing network model combined with linear

programming to meet the requirements of capacity and lead time planning for semiconductor manufacturing. EPOS is in continuous use at IBM's 300mm factory where it has become an integral tool for predicting bottlenecks, prioritizing continuous improvement efforts, planning capital investment, and managing factory lead times. EPOS has guided efforts to improve factory performance and reduce more than 30 million dollars of expense.

■ MB43

H-Room 400, Fourth Floor

Operations Management and Marketing

Cluster: Supply Chain Models
Invited Session

Chair: Xuanming Su, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

1 - Advanced Booking Programs for Managing Supply, Demand, and Price Risks in a Two-Level Supply Chain
Soo-Haeng Cho, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, Pa, 15213, United States of America, soohaeng@andrew.cmu.edu, Christopher S. Tang

While advance booking programs have been shown to be effective for manufacturers to meet uncertain demand, it is unclear if advance booking will be effective when supply, demand, and market price risks are present in a supply chain. Motivated by an advance booking program for managing these three types of risks arising in a flu vaccine supply chain, we present a two-stage Stackelberg game model to examine the dynamic interactions between the manufacturer and the retailer.

2 - Consumer Learning, Word of Mouth, and Quality Competition
Vishal Gaur, Associate Professor, Johnson School, Cornell University, vg77@cornell.edu, Young-Hoon Park, Chang Hee Park

In a competitive market, consumers are not well informed about the service levels offered by firms. Instead, they choose among firms based on past experience. Thus, the mean and volatility of demand faced by a firm become functions of the service levels provided by all firms in the marketplace. We analyze this phenomenon, and show how firms may encourage word-of-mouth to mitigate or exacerbate the effects of consumer learning.

3 - Managing Seasonal Queues with Strategic Buyers
Steven Shugan, Russell Berrie Eminent Scholar and Professor, University of Florida, 201 Bryan Hall Campus Box 117155, Gainesville, FL, 32611, United States of America, Steven.Shugan@cba.ufl.edu, Aydin Alptekinoglu

Seasonality creates predictable demand peaks during particular seasons, months, days, hours and so on. During these peaks (e.g., Christmas at Disney), strategic buyers sometimes expect greater congestion than during off-peak periods. Using queuing congestion models, we derive the best strategies for different types of seasonal peaks. We provide the logic and intuition underlying each strategy.

4 - Optimal Pricing with Speculators and Strategic Consumers
Xuanming Su, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

For limited-quantity items (e.g., tickets to sporting events, hot electronic gadgets), speculators who have no use for the product may make purchases purely with the intention of resale (e.g., over eBay). At the same time, consumers may strategically time their purchases. We study the seller's pricing problem in the presence of speculators and strategic consumers. We characterize equilibrium prices and profits and discuss model implications.

■ MB44

H-Room 402, Fourth Floor

Designing and Pricing Services

Sponsor: Service Science
Sponsored Session

Chair: Emmanuel Fragniere, Haute Ecole de Gestion, 7 Route de Drize, Carouge, Switzerland, emmanuel.fragniere@hesge.ch

1 - Knowledge Based Service Pricing : Modeling Barter Deals for Perceived Benefits Sharing
Francesco Moresino, HEG, 7 Route de Drize, Carouge, Switzerland, francesco.moresino@hesge.ch, Emmanuel Fragniere

Value added services involve human expertise from both producers and customers. In this context,the pricing scheme acts more like an organizer of the dynamic co-production process than a simple conventional "price tag". We explore modeling developments through dual mathematical programming.

2 - Taking Design Thinking and Phenomenology into Consideration for Enriching Innovation in Consultancy
Xavier Pavie, PhD candidate, Senior Researcher & lecturer, ESSEC Business School, 1 boulevard B. Hirsch, Cergy Pontoise, 95021, France, pavie@essec.fr

Facing a growth in complexity due to a series of reasons, providers of KIBS are looking for new and original ways to stimulate creativity and build relevant value-creating innovative solutions in response to the challenging questions they have to undertake. Based on an empirical study, the paper introduces KIBS issues, definition of Design and design thinking. Then, a new approach of Design Thinking articulated with philosophy to solve some KIBS's issues.

3 - Leveraging the Power of Architecture and Design in Innovative Services
Hervé Mathe, Professor, ESSEC, Boulevard BHirsch, Cergy Pontoise, France, hpmathe@yahoo.com

Organizational structures certainly are of great importance in order to determine employees'behaviour and performance. On the other hand, physical structures also significantly influence the way staff and customers view any company and interact with it. In service based activity firms and institutions are competing thanks to innovations in service portfolios, delivery processes, and management styles.

■ MB45

H-Room 410, Fouth Floor

A Deep-dive Session on Empirical NPD Research

Cluster: New Product Development
Invited Session

Chair: Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu

1 - Understanding the Dynamics of Contracting Regimes in Software Product Development Outsourcing
Sandra Slaughter, Professor of Information Technology Management and Alton M. Costley Chair, Georgia Tech College of Management, 800 W. Peachtree St. NW, Atlanta, GA, 30308, United States of America, sandra.slaughter@mgt.gatech.edu, Donald Harter, Soon Ang

This paper analyzes shifts in contracting regimes using longitudinal data on software development contracts between a software vendor and client over twenty years. Our results suggest that the changes in contracting regimes cannot be fully explained by standard explanations from contracting theory. We identify the factors that complement contractual governance in this setting.

2 - Using Networks to Evaluate Misalignment between a Design Organization and its Product Architecture
Wallace Hopp, Professor, University of Michigan, Ross School of Business, Ann Arbor, 48118, United States of America, whopp@umich.edu, Seyed Iravani, Bilal Gokpinar

We examine the vehicle development process of a large auto manufacturer. Using networks, we characterize vehicle architecture, formal communication patterns between design teams, and misalignments between the two. We show that these misalignments are positively correlated with warranty claims. Our results suggest that quality can be improved by better aligning organizational communication with product architecture and that social network analysis can be done without surveys.

■ MB46

H-Room 411, Fourth Floor

Models in Entrepreneurship

Sponsor: Technology Management
Sponsored Session

Chair: Moren Lévesque, Associate Professor, York University, Schulich School of Business, Toronto, ON, M3J 1P3, Canada, mlevesque@schulich.yorku.ca

1 - Resource Allocation Decision for the Internationalization of New Business Enterprise
Adeoye Adegorite, Graduate Student, University of Waterloo, Waterloo, ON, Canada, aiadegor@engmail.uwaterloo.ca

Many new business enterprises fail in the process of internationalizing. This is due, in part, to the challenges of allocating limited resources to sustain their local and international operations during and after internationalization. We formulate a decision model of resource allocation for the firm's local and foreign market activities. We characterize the resource allocation strategy that maximizes the firm's likelihood of survival during its internationalization process.

2 - Entrepreneurship and Regional Concentration
Graciela Kuechle, Lecturer, Witten/Herdecke University, Alfred-Herrhausen-Str.50, Witten, 58448, Germany, Graciela.Kuechle@uni-wh.de

This paper presents an evolutionary game theoretic model to show why regions may differ in terms of their levels of entrepreneurial activity even when they have similar economic potential, decisions are made simultaneously, there is migration between regions, and individuals are predisposed to imitate economically more successful agents. This model can give rise to a permanent different rate of entrepreneurship even when there is a considerable exchange among regions.

3 - Optimal Leader-Follower Strategies for Launching New Technologically-Advanced Products
John Angelis, Rochester Institute of Technology, E Philip Saunders College of Business, 105 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, jangelis@saunders.rit.edu

When launching a new, technologically-advanced product, a firm sets price and quality to maximize profits by attracting customers. However, its optimal decisions also depend on the level of innovation in customer segments and whether it is the first mover. We analyze a closed-loop Stacklberg game with perfect information. A firm will not necessarily earn more by being the first mover, and a firm with relatively high costs should target less innovative customer segments.

4 - Do IPOs Balance Innovation Against Growth?
Moren Lévesque, Associate Professor, York University, Schulich School of Business, Toronto, ON, M3J 1P3, Canada, mlevesque@schulich.yorku.ca, Nitin Joglekar, Jane Davies

Do post-IPO firms foster growth and profitability by making balanced investments in marketing and R&D, when compared with a matched sample of established firms? We specify a model of balanced growth at the firm level and test its implications for matched pairs of IPO and established firms in four industries.

■ MB47

H-Room 412, Fourth Floor

Tutorial: OR/MS Challenges in Healthcare Informatics

Cluster: Tutorials
Invited Session

Chair: Rema Padman, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, rpadman@andrew.cmu.edu

1 - OR/MS Challenges in Healthcare Informatics
Rema Padman, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, rpadman@andrew.cmu.edu

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

■ MB48

H-Sapphire Green Room, Fourth

Panel Discussion: Service Operations in an Economic Downturn

Cluster: Service Operations Management
Invited Session

Chair: Xin (David) Ding, Assistant Professor, University of Houston, T2-230C, Technology II Building, Houston, TX, 77204, United States of America, xding@Central.UH.EDU

1 - Service Operations in an Economic Downturn
Moderator: Xin (David) Ding, Assistant Professor, University of Houston, T2-230C, Technology II Building, Houston, TX, 77204, United States of America, xding@Central.UH.EDU
Panelists: Aleda Roth, Ruoyi Zhou, Richard Chase, Sriram Dasu, Rohit Verma

This panel will bring together academics and practitioners in the field of service innovation and service research. The panel will cover a variety of special issues about service operations in an economic downturn. Specifically, the panelists will discuss how service organization should re-examine issues such as customer experience management, service delivery, business process standardization across a variety of service sectors including hospitality, financial service, health care, etc.

■ MB49

H-Room 300, Third Floor

Work Sharing in Manufacturing, Distribution, and Services

Cluster: Workforce Engineering and Management
Invited Session

Chair: Yun Fong Lim, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, yflim@smu.edu.sg

1 - Service Quality vs. Efficiency in Tandem Systems
Eser Kirkizlar, Assistant Professor, SUNY - Binghamton, School of Management, Binghamton, NY, 13901, United States of America, eser@binghamton.edu, Hayriye Ayhan, Sigrun Andradottir

We study the dynamic assignment of servers to tasks in tandem systems with the objective of maximizing the long-run average profit. We assume that a revenue is earned each time a job is completed and that the quality of service is inversely proportional to the time a job spends in the system (we capture this deterioration in quality with a positive holding cost). We determine the optimal server assignment policy and study how this policy depends on the revenue and the holding cost.

2 - Polling Models for Real-time Picking and Sorting Systems in E-commence Distribution Centers
Yeming Gong, EM LYON Business School, 23 Avenue Guy de Collongue, Ecully, 69134, France, YGong@rsm.nl

E-commence distribution centers must rapidly organize the picking and sorting processes during and after the transaction has taken place, with the ongoing need to create greater responsiveness to customers. Sorting brings a large setup time, which cannot be admitted by existing polling models. We build a new stochastic polling model to describe and analyze such systems, and show how our analysis method can be applied to minimize warehouse cost or to improve service.

3 - Dynamics of Bucket Brigades in Systems with Fixed Stations
Esma Gel, Arizona State University, Dept of Industrial Engineering, P.O. Box 875906, Tempe, AZ, 85287, United States of America, Esma.Gel@asu.edu, Dieter Armbruster, Erika Murguia

We study the dynamics and throughput of a bucket brigade when work has to be conducted in stations that can only be occupied by a single worker. In particular, we define and consider different line reset rules, and provide insights on their performance with respect to line throughput and informational requirements.

4 - Order-Picking by Cellular Bucket Brigades
Yun Fong LIM, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, yflim@smu.edu.sg

We introduce a new design of bucket brigade order-picking. Under this new design, workers perform less unproductive travel compared with the traditional bucket brigades. We propose simple rules for workers to share work under the new design and find a sufficient condition for the system to self-balance. Numerical examples suggest that a higher throughput can be attained under the new design even with fewer and slower workers.

■ MB50

H-Room 302, Third Floor

Hole in One: Using Operations Research to Analyze Golf I

Sponsor: SpORts
Sponsored Session

Chair: Jason Acimovic, MIT Operations Research Center, 77 Massachusetts Avenue, E40-131, Cambridge, MA, 02139, United States of America, acimovic@mit.edu

1 - Statistics and Data Collection on the PGA TOUR
Michael Vitti, Director, Research and Development, PGA TOUR, 100 PGA TOUR Blvd, Ponte Vedra Beach, FL, 32082, United States of America, MikeVitti@pgatourhq.com

A presentation on the evolution of data collection and statistics on the PGA TOUR. The presentation will focus on the current data collection methods and competition statistics, as well as potential uses and availability of the data for academic research.

2 - Quitters Never Win: The (Adverse) Incentive Effects of Competing with Superstars
Jen Brown, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Road, Chicago, IL, 60660, United States of America, jen-brown@kellogg.northwestern.edu

Theory suggests that the benefits of tournament competition depend critically on workers' relative abilities. Using panel data from pro golf, I find that a superstar's presence in a tournament is associated with lower competitor performance. High-skill PGA golfers' 1st-round scores are 0.2 strokes higher when Woods participates, relative to when he is absent. The overall tournament effect is 0.8 strokes. This effect increases when Woods plays well and disappears during his weaker periods.

3 - How to Catch a Tiger: Understanding Golfer Putting Performance on the PGA Tour

Jason Acimovic, MIT Operations Research Center, 77 Massachusetts Avenue, E40-131, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Douglas Fearing, Stephen Graves

Our goal is to evaluate golfers in a way that eliminates biases that current PGA Tour metrics contain, and to better understand where the best golfers pick up strokes. Using The PGA Tour's ShotLink data, we develop a model for predicting putts-to-go that has the capability to valuate putts that hole out as well as those that miss. Lastly, we use this putting metric to rank all players' putting performances and compare with rankings based on existing metrics.

4 - A Simulation Model to Analyze the Impact of Golfer Skill on Score

Mark Broadie, Professor, Columbia University, 415 Uris Hall, 3022 Broadway, New York, NY, 10027, United States of America, mnb2@columbia.edu, Soonmin Ko

We develop a simulation model of the play of golfers on a golf course. The model is calibrated to professional and amateur golfer data. Using the simulation model we answer questions about the impact of changes in golfer skill on average score. For example, we quantify the value of twenty additional yards in tee shot distance and the value of increased tee shot accuracy. We also assess the relative importance of long game and short game skills on average scores.

■ MB51

H-Room 303, Third Floor

Building a Solver for Integer Bilevel Programs: Theory, Algorithms, and Software

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

Chair: Scott DeNegre, Lehigh University, Harold S. Mohler Laboratory, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, sdenegre@lehigh.edu

1 - On the Value Function of a Mixed Integer Linear Program

Menal Guzelsoy, Lehigh University, Harold S. Mohler Laboratory, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, megb@lehigh.edu, Ted Ralphs

The value function of a mixed integer linear program (MILP) is a function that returns the optimal solution value as a function of the right-hand side. In this talk, we discuss the structure of the value function of a general MILP, first focusing on the structure in the special case of a MILP with a single constraint before showing how to extend to the general case.

2 - Branch and Cut for Mixed Integer Bilevel Linear Programs: Exploiting the Lower-level Value Function

Scott DeNegre, Lehigh University, Harold S. Mohler Laboratory, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, sdenegre@lehigh.edu

We consider novel solution approaches for mixed integer bilevel programs (MIBLPs). Extensions to polyhedral techniques developed for MIPs and new valide inequalities are derived. Disjunctive cuts are from the lower-level value function. An LP method analogous to the lift-and-project method of Balas et al. is given. Generalizations of MIP heuristic and preprocessing methods are described. The Mixed Integer Bilevel Solver (MibS), a solver for MIBLP that utilizes CHiPPs, will be described.

3 - Developing Applications in CHiPPS

Ted Ralphs, Lehigh University, ISE, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Yan Xu, Scott DeNegre

In this talk, we discuss how the flexibility of the CHiPPS framework and other software modules available in COIN-OR can be leveraged to quickly develop solvers for specific problem classes. We will focus specifically on the case of our recently implemented solver for bilevel programming, which utilizes a wide range of the tools available in COIN and illustrates well the ease with which these tools can be brought together.

■ MB52

H-Room 304, Third Floor

Marketing and Operations Strategies for Perishable Products or New Products

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Dimitrios A. Andritsos, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, dimitrios.andritsos.2011@anderson.ucla.edu

1 - Revenue and Inventory Management for Perishable Products

Arvind Sainathan, University of Rochester, Simon School of Business, sainathana2@simon.rochester.edu

We consider pricing and ordering decisions faced by a retailer selling a perishable product whose shelf life is 2 periods. At the start of the first period it is new, at the start of the second period it becomes old. So every period the retailer decides the prices of new and old products, and the quantity of new product. Based on these prices and availability, customers decide what to buy with possible dynamic substitution. We consider and compare different control policies for the retailer.

2 - Maximizing Revenue of Perishable Goods through Shelf Space Allocation

Neil Geismar, Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, NGeismar@mays.tamu.edu, Milind Dawande, Chelliah Sriskandarajah

We consider the DVD rental industry, in which each newly-released title has its own revenue potential based on its box-office sales. Each display location within a store has its own effectiveness, based on visibility, so placing a DVD in a particular location generates an expected revenue. Maximizing the total expected revenue is especially important because each title's potential decays rapidly, so the display changes weekly. Display and variety constraints further complicate this problem.

3 - Optimal Pre-order Discount and Information Release

Hao Zhang, University of Southern California Marshall School of Business, zhanghao@marshall.usc.edu, Leon Yang Chu

With the proliferation of Internet retailing, selling products in advance of their actual release has gain increasing popularity. This option enables a seller to deal with consumers at an early stage when their valuations of a product are less diversified. Through an analytical model, we investigate the seller's optimal pricing strategy with the pre-order option as well as the right amount of information to release at the pre-order stage.

4 - Launching New Products through Exclusive Sales Channels

Dimitrios A. Andritsos, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, dimitrios.andritsos.2011@anderson.ucla.edu, Christopher S. Tang

A manufacturer typically introduces a new product non-exclusively through competing retailers. However, new products are increasingly launched through single sales channels via exclusive arrangements. We present two Stackelberg games to examine such arrangements. We investigate the conditions under which the manufacturer should launch the new product exclusively and examine the impact of postponing the wholesale price decision and of demand uncertainty on the manufacturer's optimal profits.

■ MB53

H-Room 305, Third Floor

Advances in Mixed Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, Department of Industrial and Systems Engineering of University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, richard@ise.ufl.edu

1 - Degree-Based Relaxations of Cliques and Stable Sets

Illya Hicks, Associate Professor, Rice University, 6100 Main St. - MS 134, Houston, TX, 77005-1892, United States of America, ivhicks@rice.edu, Benjamin McClosky

This talk will discuss algorithms for the maximum k-plex problem and the related co-k-plex coloring problem. We will present results from computational experiments and introduce a new class of facets for the k-plex polytope.

2 - Generating Cutting Planes via Dynamic Lagrangian Dual and Reduced RLT Constructs

Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com, Hanif D. Sherali

We enhance the strength of Lagrangian relaxations for solving mixed-integer programs by dynamically augmenting the Lagrangian dual with cuts induced from a disjunction implied by partial branch-and-bound enumeration. These cuts are also obtainable via an appropriate Reformulation-Linearization Technique (RLT) representation. We exploit the strength inherent in such higher-dimensional RLT reformulations, and thus also limit the number of variables controlled by subgradient optimization.

3 - A New Algorithm for Solving Relaxations of Precedence Constrained Production Scheduling Problems

Daniel Bienstock, Columbia University, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu, Mark Zuckerberg

Given a directed acyclic graph, we want to choose a closure (a set of vertices with no incoming arc) subject to side constraints of several types. In addition, we are interested in the multiperiod version of this model. Real-world problem instances have tens of millions (or more) variables and constraints. We present results with an extremely effective algorithm for optimally solving the LP relaxation of this problem.

■ MB54

H-Room 306A, Third Floor

Optimization for Online Advertisement II

Sponsor: Optimization/Networks
Sponsored Session

Chair: Aranyak Mehta, Google Research, Mountain View, United States of America, aranyak.mehta@gmail.com

1 - Algorithms for Budgeted Allocations

Gagan Goel, Graduate Student, Georgia Institute of Technology, Georgia Tech, Atlanta, GA, 30332, United States of America, gagang@cc.gatech.edu

Use of the budgeted auction model to sell advertisement space have raised several interesting algorithmic challenges. In this talk, I will present some results on the following optimization aspect of it: Given n (distinct) items and m bidders who are bidding on the items. Bidders also specify individual budget constraint. The algorithmic question is to find an allocation so that the total money obtained from this allocation is maximized.

2 - On Revenue Maximization in Second-Price Ad Auctions

Benjamin Birnbaum, University of Washington, Box 352350, Seattle, WA, 98195, United States of America, birnbaum@cs.washington.edu, Yossi Azar, Anna Karlin, C. Thach Nguyen

Most recent papers addressing the problem of allocating advertisement space for keywords in sponsored search auctions assume that pricing is done via a Ô¨Ärst-price auction, which does not realistically model the Generalized Second Price auction used in practice. In this talk, we introduce the Second-Price Ad Auctions problem, which more closely models the GSP auction. We show that the approximation complexity of this problem is quite different from that of the more-studied first-price variant.

3 - Optimizing Query Rewrites for Keyword-Based Advertising

Azarakhsh Malekian, Student, University of Maryland, College Park, AV Williams Bldg, UMD-CP, College Park, MD, 20742, United States of America, malekian@cs.umd.edu

We consider the problem of query rewrites in the context of keyword advertisement. Given a three-layer graph consisting of queries, query rewrites, and the corresponding ads that can be served for the rewrites, we formulate a family of graph covering problems whose goals are to suggest a subset of ads with the maximum benefit by suggesting rewrites instead. We obtain constant-factor approximation algorithms for these, under two versions of constraints and a realistic notion of ad benefit.

4 - Sort-Cut: A Mechanism for Multi-Unit Auctions with Budget-Constrained Bidders

Amin Sayedi, Carnegie Mellon University, 4041 Bigelow Blvd, Apt 105, Pittsburgh, PA, 15213, United States of America, amin23@gmail.com, Isa Hafalir, R Ravi

We study multi-unit auctions of a single item. A recent impossibility result [Dobzinski et al., FOCS'08] precludes the existence of a truthful mechanism with Pareto-optimal allocations in this important setting. We propose Sort-Cut, a mechanism which does the next best thing from the auctioneer's point of view, that we term semi-truthful. In our mechanism, it is a weakly dominant strategy for all agents to state their true budgets and to not understate their values.

■ MB55

H-Room 306B, Third Floor

Empirical Results on Finance-operations Interface

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: John BirgeProfessor, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, john.birge@chicagogsb.edu

1 - An Empirical Study of Supply Chain Management with Trade Credit

Song (Alex) Yang, The University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, 60637, United States of America, syang1@chicagobooth.edu, John Birge

In this talk, we will present empirical results on how companies in a supply chain use trade credit.

2 - Stocking Decisions for a Public Newsvendor

Richard Lai, Assistant Professor, The Wharton School, University of Pennsylvania, Huntsman Hall, Philadelphia, PA, United States of America, lairk@wharton.upenn.edu, Vishal Gaur, Ananth Raman

We model the stocking decision of a public newsvendor, i.e., a newsvendor whose shares are listed on the stock market. Consistent with practice and literature in corporate finance, we assume some information asymmetry between the newsvendor and the market, and also assume that the newsvendor maximizes a weighted combination of its expected profit and its short-term market valuation. We study the newsvendor's operating choices and the market's valuation of the firm, with broader implications.

3 - The Effect of Product Development Restructuring on Shareholder Value

Vinod Singhal, Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St NW, Atlanta, GA, 30308, United States of America, vinod.singhal@mgt.gatech.edu, Brian Jacobs

This paper analyzes the shareholder value effects of product development restructuring (PDR) by measuring the stock market reaction associated with announcements of PDR. On average, we find a significant 0.87% increase in stock value. We also segregate our sample to determine the effects of the announcing firm's prior financial performance, intent behind the restructuring, R&D intensity, and size on the abnormal returns associated with PDR.

4 - Technological Risk, Market Value and Financial Risk of Firms in the Medical Device Industry

Kingshuk Sinha, University of Minnesota, Carlson School of Management, 321-19th Avenue S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, ksinha@umn.edu, Sriram Thirumalai

Product recalls resulting from failures of high tech products in the market place exemplify technological risks for high tech firms. In this study, we investigate how the market value and financial risk profile of firms are impacted by the announcement of a product recall. The medical device industry will serve as the empirical context of the study.

■ MB56

H-Room 307, Third Floor

Global Optimization of MPECs and Bilevel Programs

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

1 - Global Solution of Bilevel Mixed-Integer Nonlinear Programs

Alexander Mitsos, Assistant Professor, Massachusetts Institute of Technology, Department of Mechanical Engineering, 77 Massachusetts Avenue, MIT 3-158, Cambridge, MA, 02139, United States of America, mitsos@MIT.EDU

A deterministic algorithm for the global solution of bilevel mixed-integer nonlinear programs is presented. It is the first algorithm to guarantee finite termination with a global solution for programs with nonconvex functions. It is based on a recent proposal for continuous bilevel programs [Mitsos et al. JOGO 2008] and relies on a convergent lower bound and an optional upper bound. Convergence is achieved by adding upper bounds to the parametric objective value of the lower-level program.

2 - A Benders Decomposition Method for Discretely-constrained MPECs

Yohan Shim, University of Maryland, College Park, 1914 Sterling Green Dr., Morrisville, NC, 27560, United States of America, yshim@umd.edu, Steven Gabriel

We present a new variant of Benders method combined with a domain decomposition method to solve discretely-constrained mathematical programs with equilibrium constraints (DC-MPECs).

3 - Inequalities for Covering Sets via Lifting and Orthogonal Disjunctions

Kwanghun Chung, PhD Candidate, Department of Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesvile, FL, 32611, United States of America, khchung@ufl.edu, Jean-Philippe Richard, Mohit Tawarmalani

We discuss our recent results on valid inequalities for nonlinear covering sets. These results highlight the importance of orthogonal disjunctions in the derivation of valid inequalities and emphasize the potential of lifting for mixed integer sets. In particular, we provide convex hull descriptions of continuous polynomial covering sets and facet-defining inequalities for their 0-1 mixed integer counterparts.

4 - On the Application of Partial B-regularity to a Class of Repeated Game Models Formulated as MPECs

Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, AndrewLiu@purdue.edu

We present an optimization model that describes a collusive game among non-cooperative players. The problem contains an implicit optimal value function and is reformulated to a mathematical program with equilibrium constraints (MPECs). It is shown that the (convexified) MPECs satisfy the so-called partial B-regularity, and hence, any B-stationary point of such an MPEC is a globally optimal solution.

■ MB57

H-Room 308, Third Floor

Healthcare Potpourri

Sponsor: Health Applications
Sponsored Session

Chair: Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu

1 - Design and Analysis of Ambulance Diversion Policies

Adrian Ramirez Nafarrate, Arizona State University, 607 W. 19th Street A13, Tempe, AZ, 85281, United States of America, adrian.ramirez@asu.edu, Teresa Wu, John Fowler, Esma Gel

The overcrowding situation in Emergency Departments (ED) of hospitals causes multiple problems affecting the patients, such as long waiting times, patients leaving without treatment, boarding and ambulance diversion.Even though EDs have been studied recently, analytical tools have not been applied extensively on the design and analysis of diversion policies.This research uses Simulation and Markovian models to study the trade-offs of diversion policies and the impact on the performance of the ED

2 - Staffing for Disease Management: The Third Party Payer Perspective

Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu, Amy R. Wilson, Scott Sandok

Saddled with increasing healthcare costs, health insurance organizations in the United States are looking at new ways to improve health outcomes using telephonic interventions. The uncertainty involved in these interventions leads to questions regarding 1) staffing levels and 2) measurement of the effectiveness of the interventions. We present a case study from BlueCross BlueShield of Minnesota that examines these questions.

3 - The Payer Has Problems

Amy R. Wilson, Blue Cross and Blue Shield of Minnesota, 3535 Blue Cross Road, R259, Eagan, MN, 55122, United States of America, Amy_R_Wilson@bluecrossmn.com

The responsibilities of health insurance companies, or third party payers, have evolved from paying claims to also include improving the health of their members, creating innovative benefit designs, and creating networks that provide broad access to high quality/low cost healthcare providers. Problems faced by the payer have not been widely studied. This talk will describe how they may be amenable to operations research techniques, and the challenges posed by the data available to the payer.

4 - Multi-Criteria Models for Physician Productivity Measurement

John Osborn, Operations Manager, Mayo Clinic, 200 1st St SW, Mary Brigh 2-505, Rochester, MN, 55905, United States of America, Osborn.John@mayo.edu

Efficient use of resources is a critical issue for health care providers. At an academic medical center, physicians and surgeons have obligations beyond patient care, yet typically measures of academic productivity are qualitative and subjective. This paper proposes a multi-criteria model for evaluating physician productivity at an academic medical center, with considerations for pay-for-value and pay-for-performance reimbursement schemes.

■ MB58

H-Room 309, Third Floor

Supply Chain Scheduling Cooperation, Coordination and Subcontracting

Cluster: Scheduling
Invited Session

Chair: Zhi-Long Chen, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@rhsmith.umd.edu

Co-Chair: Lei Lei, Rutgers University, Dept of SCM & Marketing Sci., Rutgers Business School, Newark & New Brunswick Campuse, NJ, United States of America, llei@andromeda.rutgers.edu

1 - Conflict Resolution in a Two Stage Production Line

Manoj Vanajakumari, Texas A&M University, Department of Engineering Technology and, United States of America, manoj@entc.tamu.edu, Chelliah Sriskandarajah, Edouard Wagneur

We study a two-stage production system connected by an intermediate buffer. The objective of the paper is to find schedules for the two stages which minimize the system cost. The problem is shown to be NP-hard. We demonstrate that the cost saving which cooperation between the stages provides is significant.

2 - Production and Logistics Coordinated Scheduling Problems in the Steel Industry

Lixin Tang, Northeastern University, The Liaoning Key Lab. of Manuf. & Logist, The Logistic Institute, Shenyang, 110004, China, lixintang@mail.neu.edu.cn

Production and logistics coordination is critical in steel industry. Effective coordinated scheduling can significantly improve WIP inventory, lower energy consumption and reduce logistics cost. We study coordinated scheduling of: 1) production and warehousing; 2) production and transportation. Computational complexity is analyzed. For NP-hard problems, heuristics with worst-case analysis or optimization algorithms are proposed. For polynomial solvable cases, effective algorithms are given.

3 - Time Sensitive Capacity Allocation Issues in Subcontracting

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu, George Vairaktarakis

We study the subcontracting strategies of a manufacturer utilizing processing capacity both in-house and at a third-party which is common to competing manufacturers. In this setting, a time-sensitive capacity allocation problem arises since every manufacturer balances the in-house production and outsourcing costs, his sensitivity to delay, and effects of competitors. We consider and evaluate the third-party's and the manufacturers' performance in both centralized and equilibrium schedules.

4 - On Multimodal-Shipping Scheduling Problem with Customer Receiving Deadlines

Lei Lei, Rutgers University, Dept of SCM & Marketing Sci., Rutgers Business School, Newark & New Brunswick Campuse, NJ, United States of America, llei@andromeda.rutgers.edu, Gang Wang

We derive the minimum-cost operation schedules for a shipping network of many suppliers, distribution centers and customers subject to the capacity and time window constraints. We show the structure properties of this problem, and present a solvable case via decomposition. An approximation algorithm for the general cases is discussed.

■ MB59

H-Room 310, Third Floor

Tutorial: OR's Next Top Model: Decision Models for Infectious Disease Control

Cluster: Tutorials
Invited Session

Chair: Elisa Long, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu

Co-Chair: Margaret Brandeau, Professor, Stanford University, 407 Terman Engineering Center, MS&E Department, Stanford, CA, 94305, United States of America, brandeau@stanford.edu

1 - OR's Next Top Model: Decision Models for Infectious Disease Control

Elisa Long, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu, Margaret Brandeau

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

■ MB60

H-Room 311, Third Floor

Revisiting Interior Point Methods

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Revisiting Homogeneous Self-Dual Method for Linear Programming

Sanjay Mehrotra, Professor, Northwestern University, IEMS Department, MEAS, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, Kuo-Ling Huang

The homogenous self-dual formulation has many advantages over the standard KKT based formulations to construction primal-dual interior point methods. Computational performace of a potential reduction based implementation of such a method is not known. We will present computational results showing that the number of iterations in this method are similar to the standard interior implementations while ensuring a worst case complexity.

2 - On the Complexity of L-p Norm Minimization for p Less than One

Yinyu Ye, Professor, Stanford University, Terman 316, Stanford University, Stanford, CA, 94305, United States of America, yyye@stanford.edu

Recently, L-p norm minimization for p less than 1 is used to compute a sparse solution for a system of linear equations. We show that the problem is NP-hard for all 0<p<1. On the positive side, we show that the interior-point potential reduction or affine scaling algorithm works well to compute a local minimizer in FPTAS time.

3 - A Row-by-row Interior-point Method for Semidefinite Programming

Zaiwen Wen, NSF Math Institutesí postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Donald Goldfarb, Shiqian Ma, Katya Scheinberg

We present an interior-point method for semidefinite programming (SDP) that iteratively updates a single row (and column) of the unknown matrix at each iteration. The method uses both the properties of the Schur complement and an augmented Lagrangian approach. Numerical results will be presented to illustrate the method's ability to solve very large SDPs in a very modest amount of time.

■ MB61

H-Room 312, Third Floor

Facility Location under Disruption Risks

Sponsor: Location Analysis
Sponsored Session

Chair: Ho-Yin Mak, The Hong Kong University of Science and Technology, Department of IELM, HKUST, Clear Water Bay, Hong Kong, Hong Kong - PRC, hymak@ust.hk

1 - Risk-Diversification and Risk-Pooling in Supply Chain Design

Ho-Yin Mak, The Hong Kong University of Science and Technology, Department of IELM, HKUST, Clear Water Bay, Hong Kong, Hong Kong - PRC, hymak@ust.hk, Max Shen

Recent research has pointed out that the optimal strategies to mitigate supply disruptions and demand uncertainty are often mirror images of each other. In particular, risk-diversification is favorable under the threat of disruptions and risk-pooling is favorable under demand uncertainty. We show that supply chain networks that allow small to moderate degrees of dynamic sourcing provides partial benefits of both strategies and can be very robust against both disruptions and demand uncertainty.

2 - Conic Program for a Capacitated Location-Inventory Model with Unreliable Supply and Transportation

Gemma Berenguer, PhD student, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, 94720-1777, United States of America, gemmabf@berkeley.edu, Alper Atamturk, Max Shen

In some supply chain settings, link disruptions are as relevant as node disruptions. We present a formulation of a capacitated location-inventory model with risk pooling that incorporates supply and transportation disruption risks. The model is a nonlinear mixed-integer problem that we solve by reformulating it as a second-order conic mixed-integer program. We show computational effects of varying DC capacities, inventory and shipping costs and we improve them by adding valid cuts.

3 - Pre-disaster Protection Planning Against Disruptions Affecting Large Geographical Areas

Federico Liberatore, PhD Student, Kent Business School, University of Kent, Canterbury, CT2 7PE, United Kingdom, fl51@kent.ac.uk, Mark Daskin, Paola Scaparra

We present a model to plan for the fortification of critical system components in the face of disastrous events that affect wide areas, such as floods, earthquakes, hurricanes, and the spreading of biological and chemical agents. Both heuristic and optimal solution approaches are shown.

■ MB62

H-Room 313, Third Floor

Behavioral Modeling and Experiments

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Diana Wu, Univerisity of Kansas, 1300 Sunnyside Ave., Lawrence, United States of America, dianawu@ku.edu

1 - Adaptive Estimation of Bounded Rationality and Risk Preferences

Tad Hogg, HP Labs, MS 1139, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, tad.hogg@hp.com, Kay-Yut Chen

We describe calibrating behavioral economic decision models with simple decision problems. To minimize the required number of decisions, we propose an adaptive procedure that dynamically constructs test decisions to measure the levels of two key behavioral effects: bounded rationality (propensity to make inconsistent choices) and risk aversion in individual decision-makers. Simulation experiments show this approach outperforms a static process where test decisions are all pre-determined.

2 - Comparison of Perceptions and Behavior in Ticket and Physical Queues

Kaan Kuzu, The Pennsylvania State University, Smeal College of Business SC&IS Dept., 471B Business Building, University Park, PA, 16802, United States of America kzk107@psu.edu, Susan Xu, Christopher Craighead

We designed an empirical study to obtain insights into participant perceptions of and behavior within different queuing arrangements. We specifically focused on the decision making process and the patience of the participants before and during waits in ticket and physical queue arrangements. We also examined the impact of time pressure and patience on the perceptions of ticket and physical queues.

3 - Newsvendor Order Distribution under Contracts with Threshold
Diana Wu, Univerisity of Kansas, 1300 Sunnyside Ave., Lawrence, United States of America, dianawu@ku.edu, Kay-Yut Chen

We use a series of experiments to study the behavior of a newsvendor retailer under supply chain contracts that involve threshold, for example, quantity discounts and sales target rebate. All earlier newsvendor experiments focus on the analysis of the average of ordering decisions. In this study, we look at the overall order distributions under different contracts. We propose a behavioral model based on quantal response to describe the observed behavioral changes in order distributions.

■ MB63

H-Room 314, Third Floor

Drugs in Health Care

Contributed Session

Chair: David Czerwinski, Assistant Professor, San Jose State University, One Washington Square, San Jose, CA, 95192, United States of America, david.czerwinski@sjsu.edu

1 - Does Medicare Part D Influence Physicians' Prescribing Patterns?: Long-term Care Center Study
Changmi Jung, PhD Student, Carnegie Mellon University, 4800 Forbes Ave. Rm 242, Pittsburgh, PA, 15213, United States of America, changmi@cmu.edu, Rema Padman

We would like to understand if Medicare Part D influences physicians' drug prescribing patterns in long-term care centers. We believe that physicians typically prescribe generic or preferred drugs based on the insurance plan of the patients, but it does not happen in many cases because of varied information and coverage of each plan. We collect prescription order data from an online pharmacy which has 120 long-term care center clients and analyze it to answer the above question.

2 - An Improved Distribution Contract for the Pharmaceutical Industry
Kathleen Martino, PhD Candidate, Rutgers Business School, 180 University Avenue, Newark, NJ, 07102, United States of America, martinok2@gmail.com, Yao Zhao

We compare the current Fee-for-Service (FFS) contract in the US pharmaceutical supply chain to a Fee for Distribution (FFD) contract for brand drugs using a model-based mathematical approach. We consider predictable demand and show that the FFD contract outperforms the current FFS contract by reducing the distributor's inventory and smoothing the manufacturer's demand.

3 - An Optimization-based Approach to Drug Safety Surveillance
David Czerwinski, Assistant Professor, San Jose State University, One Washington Square, San Jose, CA, 95192, United States of America, david.czerwinski@sjsu.edu, Dimitris Bertsimas

Ensuring the safety of the US drug supply continues to be a pressing concern, with the recall of Vioxx earlier this decade and problems with tainted supply chains more recently. Insurance claims data are a promising source for detecting unexpected adverse reactions to drugs. We will discuss the statistical challenges involved in monitoring drug safety and present an optimization-based surveillance method. Simulation results comparing our approach to existing methods will also be presented.

■ MB64

H-Room 202A, Second Floor

Communication Instruction in Engineering and Business Schools II

Sponsor: INFORM-ED (Education Forum)

Sponsored Session

Chair: Judith Norback, Dir., Workplace & Academic Comm, Stewart School of Indus & Sys Engineering, Georgia Tech, 755 Ferst Drive, Atlanta, GA, 30332, United States of America, jnorback@isye.gatech.edu

Co-Chair: Elke Leeds, Assistant Professor, Kennesaw State University, School of Accountancy Coles College of B, 1000 Chastain Road - Bldg. #4 Office - B, Kennesaw, GA, 30144, eleeds@kennesaw.edu

1 - Professional Presentation as Performance
Rick Evans, Director, Engineering Communications Program, Cornell University, College of Engineering, Rae27@cornell.edu

Performance is a 'contested concept' that emerges from a range of disciplines. It is most commonly understood as a recurring collection of actions carried out for someone else with a self conscious, reflexive awareness. Performance is a useful concept for teaching presentations because it replaces the transmission of information as the focal aim with the experience of meaning and therefore emphasizes the design of that experience. Consequently, students understand themselves in their presentations to be acting in ways to create an experience that in turn allows others to act as well.

2 - Developing the Professional Communications for Engineers Course at Texas Tech University
Dean Fontenot, Sr. Director T-STEM Center, Texas Tech University, College of Engineering, Dean.fontenot@ttu.edu

Because of the concern that students were not graduating from the College of Engineering with good communication skills, I was asked to develop and deliver a course that would not only address ABET criteria but would help engineering students to become better oral, written, and internet communicators. This presentation will discuss the development and delivery of the course, how it addresses accrediting boards' criteria, fits into the core curriculum, and how we are investigating ways to replicate the course in order to serve the large number of engineering students at Texas Tech University.

3 - Preliminary Scoring System for Engineering Student Presentations, Based on Executive Input
Judith Norback, Dir. of Workplace and Academic Communication, Georgia Tech, Stewart School of Industrial and Systems, judith.norback@isye.gatech.edu, Tristan T. Utschig

At Georgia Tech, we have created a preliminary scoring system for engineering student presentations. The scoring system is based on input from business executives during structured focus groups. We identified six categories of skills from the executives' input: 1) Customizing the presentation to the audience, 2) Interacting with the audience, 3) Delivering the presentation, 4) Telling the story, 5) Sequencing the topics, and 6) Focusing on key points. We will give examples of each of these categories and share with the audience the resulting 4-level preliminary scoring system

4 - Integrating Managerial Presentation Skills in Business School Courses on Spreadsheet Analytics & Management Science
Thomas A. Grossman, Associate Professor of Finance & Quantitative Analytics, University of San Francisco, School of Business and Management, San Francisco, CA, tagrossman@usfca.edu, Mouwafac Sidaoui

We teach MBAs to be effective business analysts by delivering the Business Analytics Lifecycle of Modeling/Formulation, Spreadsheet Engineering, Analytics, Interpretation, and Communication. We will discuss how we help students encapsulate a complex analysis in a presentation that speaks to a managerial audience. And we will describe "asynchronous PowerPoint" in business and the importance of stand-alone PowerPoint decks.

■ MB75

C-Room 32A, Upper Level

Railway Crew Scheduling

Sponsor: Railroad Applications

Sponsored Session

Chair: Kamalesh Somani, Mgr Operations Research, CSX Transportation, 500 Water Street, Jacksonville, FL, 32258, United States of America, Kamalesh_Somani@CSX.com

1 - A Decision Support System for Railroad Crew Planning
Krishna Jha, Innovative Scheduling Systems, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States of America, krishna@innovativescheduling.com, Ravindra Ahuja, Amit Agarwal

Railroads do crew planning based on crew districts and different crew districts have different configurations - one home and one away location, multiple home and/or multiple away locations, short-long pools, triangular pools, etc. We have developed a decision support system for crew planning that can handle various types of crew districts in an integrated manner. We will describe the features of this system and give its demonstration.

2 - A Simulation-based Crew Planning Model to Improve Crew Utilization and Train Performance
Yudi Pranoto, Operations Research Specialist, Norfolk Southern, 1200 Peachtree St. NE, Atlanta, GA, 30309, United States of America, yudi.pranoto@nscorp.com, Clark Cheng

Norfolk Southern developed a simulation-based crew planning model to evaluate the impact of changes in government regulation, union agreement and train schedule on crew utilization and train service. We will present the motivation behind the development of this model and its usage. We will describe in detail key modules of this system such as crew deadheading and detention, relieve crew, and animation.

3 - Strategic and Real-time Crew Scheduling Models at CSX Transportation
Kamalesh Somani, Mgr Operations Research, CSX Transportation, 500 Water Street, Jacksonville, FL, 32258, United States of America, Kamalesh_Somani@CSX.com, Jagadish Jampani

Railway crew scheduling problems are complex in nature. Currently, it is mostly a manual process resulting in avoidable expenses and planning time. Crew scheduling is dependent on configurations like single/doubly-ended, split, triangle, short/long pools. In the past, CSX implemented a strategic crew planning system for single/doubly-ended configurations. Recently, we added an array of network flow models to address more complex configurations from both strategic and real-time perspectives.

■ Interactive Session

Monday, 12:30pm - 1:30pm

Exhibit Hall

1 - ORA Network Analysis Software
Terrill Frantz, Carnegie Mellon University, ISR/SCS 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, terrill@org-sim.com

Used to locate individuals and groups that are risks given social, knowledge and task network information. Using the visualization and computational features the health of an organization can be assessed; key actors who by virtue of who they know, what they know, and what they are doing can be identified.

2 - Data Mining Application for Personnel Selection and Performance Evaluation in Banking Sector
Ertan Guner, Professor/ Doctor, Gazi University, Celal Bayar Boul. 06570, Maltepe, Ankara, Turkey, erguner@gazi.edu.tr, Hamdi Bilen, Kemal Alaykiran

As the communication technologies have been progressing, it has been easier to reach current information and knowledge discovery concept has increasingly become important. The necessity of turning huge amounts of data into useful information indicates the importance of data mining. Personnel quality is an important point for companies in order to maintain competitive advantages. In this study, an effective personnel selection mechanism is improved by classification and clustering methods.

3 - Efficient Frontier in Consumer Loan Decision when Considering Profit, Volume and Variance on Profit
Kanshukan Rajaratnam, Student, University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States of America, kanshu@virginia.edu

Literature describes choosing between consumer credit scorecards in a manner that is efficient with respect to a set of conflicting business objectives, such as profit, market share, and losses. We extend the above to include variance in profit as a constraint. We construct the efficient frontier where the portfolio manager is faced with the decision to choose a scorecard when creating a portfolio that is efficient with respect to profit and volume while within the variance on profit constraint.

4 - Ranking College Football Teams with AHP Concepts
Yepeng Sun, PhD Student, University of Louisville, 789 Eastern Pkwy, Apt 4, Louisville, United States of America, y0sun010@louisville.edu, Gerald Evans

Analytical Hierarchy Process(AHP) has proved to be an appropriate approach to deal with inconsistent problems. This presentation will introduce a new approach to rank football teams with a method evolved from AHP concepts.

5 - Sourcing Strategies for Relief Agencies Given In-kind Donations Availability
Luther Brock, Doctoral Student, North Carolina A&T State University, 404 McNair Hall, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, lbrock@ncat.edu, Lauren Davis

This research studies the challenges faced by relief agencies when providing prolonged assistance during disaster relief. A mathematical model identifies sourcing decisions over a finite time horizon by balancing capital investments from transshipments and local market purchases with the consequences of processing capacity degradation resulting from handling undesired items comingled with donations received.

6 - Design Insights for Warehousing Systems Using Autonomous Vehicles Technology
Debjit Roy, Research Assistant, University of Wisconsin-Madison, Dept of ISyE, 1513 University Avenue, Madison, WI, 53706, United States of America, droy@wisc.edu, Ananth Krishnamurthy

Autonomous vehicle storage and retrieval systems (AVS/RS) represent a relatively new and flexible technology that is used as an alternative to crane-based AS/RS. In AVS/RS, autonomous vehicles provide horizontal movement within a tier whereas lifts provide vertical movement between tiers. In this research, a detailed simulation model is used to understand the effect of design parameters such as vehicle assignment rule, number of zones and location of the cross-aisle on system performance.

7 - Pattern Recognition and Sequence Analysis in Communications
Selcen Phelps, Westminster College, 501 Westminster Ave, Fulton, MO 65251, United States of America, selcen.phelps@westminster-mo.edu, William Guinee

In an extension of pattern recognition methodology to the social sciences, we use encoding, counting algorithms, and statistical methods (such as the Binomial Test), to test hypotheses regarding patterns in communications. An anthropology application analyzes Alcoholics Anonymous narratives to discover significant themes and sequences. Other applications are being proposed for the analysis of human decisions and dialogue, most notably in the framework of social media.

8 - The Development of a Multi-modal Trip Planner
Jing-Quan Li, Assistant Research Engineer, Calfornia PATH, UC Berkeley, Richmond, CA, 94804, United States of America, jingquan.li@gmail.com

We will discuss the development of a multi-modal trip planner for metropolitan areas. The planner will provide different transportation modes, including driving, transit and park-and-ride. The real-time traffic and transit information is incorporated.

9 - Intellectual Property Management in Japanese Companies
Koichiro Kato, Professor, Kanazawa Institute of Technology, 1-3-4-12F, Atago, Minato-ku, Tokyo, 105-0002, Japan, kkato@neptune.kanazawa-it.ac.jp, Kazunari Sugimitsu

Intellectual property management is important in technology management. Intellectual property department is in charge of strategic intellectual property management. But the relations between the department and intellectual property management are not clear. We investigated about the relations in Japanese companies by questionnaires to clear the points and analyzed statistically.

10 - Reverse Logistics Network Design and a Mixed Integer Programming Model for Accumulator Recycling System
Bahar Ozyörük, Assistant Professor, Gazi University, Gazi University Faculty of Achitecture, and Engineering Industrial Eng. Dept., Ankara, 06520, Turkey, bahar@gazi.du.tr

The paper deals with the recycling network design which is a reverse logistics activity. A mixed integer programming model with multi-product aiming at minimazing the cost for accumulator recycling system is developed and the real system tried to modelling.

11 - Tactical Production Planning with Deterioration and Perishability
Julia Pahl, Research and Teaching Assistant, Universitat Hamburg, Von-Melle-Park 5, Hamburg, Germany, pahl@econ.uni-hamburg.de, Stefan Voss, David Woodruff

As organizations move from creating plans for individual production lines to entire supply chains it is important to recognize that planning decisions impact the quality-state of products. Products passing their useful lifetime impose high costs due to inventory loss or the need to rework them. We provide some interesting insights.

12 - Solving Order Acceptance and Capacity Planning in Make-to-Order Operations with Branch and Price
Siddharth Mestry, Research Assistant, Florida International University, 10555 W Flagler St., EC 3120, Miami, FL, 33174, United States of America, smest001@fiu.edu, Purushothaman Damodaran, Chin-Sheng Chen

Make-to-Order firms can make sustainable profits by selectively accepting customer orders and simultaneously planning for their capacity. To solve this integrated problem, we propose a Mixed-Integer Linear Program. We decompose this MILP into a master problem and one or more sub-problems and solve it using an exact Branch and Price algorithm. We also propose an approximate branch and price scheme, lagrangean bounds and approximation algorithms to solve the problem efficiently.

13 - Estimating the Term Structure of Credit Spreads in Illiquid Markets
Gonzalo Cortazar, Professor, P. Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago, Chile, gcortaza@ing.puc.cl, Claudio Tapia

This paper presents a methodology for estimating a family of credit spread term structures in a market with few transactions. We propose partitioning the market into risk classes, such as credit ratings, and modeling credit spread term structures for each risk class using a multifactor Vasicek model with some common and some risk-class-specific factors. The model is jointly estimated using an Extended Kalman Filter. An application using Chilean corporate bonds is presented.

14 - An Analysis of Knowledge Affected by Differences of Work Experience in Intellectual Property Field
Masako Wakabayashi, Association of Intellectual Property Education, 3-13-7-3F, Nishishinbashi, Minato-ku, Tokyo, 105-0003, Japan, wakabayashi@ip-edu.org, Atsushi Inuzuka, Toshiya Watanabe, Nozomi Ashida, Koichiro Kato, Kazunari Sugimitsu

It is important for human resources in intellectual property field to acquire knowledge closely relevant to business practice. Therefore, we analyze the examinee data of "The Examination of Proficiency in Intellectual Property" as proxy variable, with the intention of making clear what kind of knowledge is affected by work experience.

15 - Redundancy and Projection Operation in Lift-and-project Procedures for the Max-cut Problem
Jiwoong Choi, Korea University, 1, 5Ka, Anamdong, Seongbookku, Seoul, Korea, Republic of, miracleno7@korea.ac.kr, In-Chan Choi

We address implementation issues in lift-and-project procedures for the max-cut problem. A redundancy checking scheme is considered to deal with exponential growth in constraints. Also, projection operators are examined for efficient projection of lifted polyhedrons onto original space. Preliminary computational results based on three lift-and-project methods are presented.

16 - Operations Research for Early Diagnosis of Breast Cancer
Turgay Ayer, University of Wisconsin, 1513 University Ave., Madison, WI, 53708, United States of America, tayer@wisc.edu, Oguzhan Alagoz, Natasha Stout, Elizabeth Burnside

Breast cancer is the most common cancer and second leading cause of death among US women. When detected early through screening, the disease is effectively curable. Although mammography is the most common screening modality, its false negative and false positive rates are high. We build an artificial neural network (ANN) to improve the accuracy of risk prediction in mammography reading and a partially observable Markov decision process (POMDP) model to optimize mammography decisions.

17 - A Quantitative Approach Towards Sustainable Organizations
Fikret Turan, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, fkt1@pitt.edu

A new, comprehensive management tool for organizational sustainability using stakeholder theory, analytic network process and stochastic programming has been developed and tested to create an optimal investment portfolio. The portfolio balances economic, social and environmental aspects (i.e., the triple bottom line) with internal rate of return.

18 - Evaluating Emergency Medical Service Dispatching Policies
Rebecca Dreiding, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave, Richmond, VA, 23284, United States of America, dreidingra@vcu.edu, Laura McLay, James Denison

How to locate and dispatch ambulances responding to 911 calls is a major responsibility of emergency medical service systems. This research provides a model for optimizing dispatching protocols, which potentially has a large effect on patient outcomes. Our model sheds light on when to dispatch the closest medical unit to a call and when to dispatch a farther medical unit to a call.

19 - Revenue Management and Capacity Allocation with Limited Information in Global Air Cargo Operations
Ravi Kumar, Distinguished Professor and Dean, KAIST Busness School, Seoul, 130702, Korea, Republic of, Rkumar@marshall.usc.edu, Seungbeom Kim

With limited information on demand, several models to improve the revenues of an air cargo company are developed, with focus on capacity allocation to their global regional sales offices. The results show that their revenue increases significantly even when we use the simplest developed models compared to their current methods.

20 - A Heuristic Based Scheduling System for Diffusion Processing in Semiconductor Manufacturing
Tanju Yurtsever, Freescale Semiconductor, Inc., 6501 William Cannon Drive West, Austin, TX, 78735, Tanju.Yurtsever@freescale.com, Erhan Kutanoglu, Jennifer Johns

This talk addresses the scheduling of lots in a specific wafer fabrication area, called diffusion, where scheduling of lots interact with batching, equipment dedication, and queue time constraints. Realizing the difficulty of solving the underlying mathematical program optimally, we develop a heuristic to regularly schedule the lots available in the area in real time. The talk explains the user interface and implementation issues as well as the details of the heuristic logic. The results obtained from production in a wafer fabrication facility to date show high user compliance, improved predictability and visibility of the overall schedule, and improved operational performance including reduced cycle times and queue time violations.

21 - Optimal Design of Business Processes
Ronald Giachetti, Associate Professor, FIU, 10555 W. Flagler Street, Miami, FL, 33174, United States of America, giachetr@fiu.edu

This paper develops a queueing network model that incorporates the division of labor and coordination between activities. An optimization model to minimize the cycle time subject to a maximum number of servers is presented. We derive an upper bound on the number of subtasks and present an algorithm to optimally solve the problem. The model, analytical, and numerical results provide a means to determine the optimal number of subtasks for a process that was until now missing from the literature.

22 - A Linear Model for an Integrated Location-inventory Problem with Time-based Service Level Constraints
Eissa Nematollahi, York University, 4700 Keele Street, Toronto ON, N2L 3G1, Canada, eissa@yorku.ca, Abdullah Dasci, Fatma Gzara

We present an integrated network design and inventory problem in service-parts logistics systems design. The existing models are usually very difficult to solve due to demand uncertainty and highly nonlinear service-level constraints. Exploiting unique properties of the nonlinear constraints, we provide an equivalent linear formulation, which can be solved quickly and efficiently.

23 - How to Protect Intellectual Property under R&D Outsourcing
Rajorshi Sen Gupta, Research Fellow, Texas A&M University, College Station, College Station, TX, 77840, United States of America, rajorshi@tamu.edu, H Alan Love

R&D outsourcing has become a strategic tool for companies to abate production costs/develop new products. While sharing of intellectual property by clients can facilitate vendor learning, it can also lead to eventual misappropriation . We design an incentive compatible mechanism that can help companies protect their IP while outsourcing R&D.

24 - Multi-objective Healthcare Decision Support: Case Studies in UK and China
Dylan Jones, Principal Lecturer, University of Portsmouth, Department of Mathematics, Lion Terrace, Portsmouth, PO1 3HF, United Kingdom, dylan.jones@port.ac.uk, Mehrdad Tamiz, Patrick Beullens

Two case studies relating to multi-objective decision support are presented. The first pertains to the planning of a medical assessment unit in an acute care hospital in Portsmouth, UK. A combination of goal programming and simulationis used to provide information on resource levels and answer what/if questions. The second relates to a general hospital in Zichaun, China. A combination of goal programming and queuing theory is used to allocate beds amongst departments.

25 - Gemcutting Strategies for Fast Simplex Variants and Combinatorial Proofs on Polytopes
Anand Kulkarni, University of California, Berkeley, 4141 Etcheverry Hall, Berkeley, CA, United States of America, anandk@berkeley.edu

We present a new technique for determining how the edge-vertex graph of a polytope and paths between vertices are modified by constraint perturbations and cutting planes. This method has direct applications in determining faster Simplex-like algorithms for linear programming, and has yielded new results in outstanding problems in the theory of polytopes, including the Hirsch conjecture and questions about random walks on polytopal graphs.

26 - Product Pricing and Company Wealth: An Example From Airline Industry
Min Shi, Assistant Professor, California State University Los Angeles, 5151 State University Drive, Los Angeles, CA, 90032, United States of America, mshi2@calstatela.edu

The current literature extensively documents the relationship between price strategy and stockholder wealth, but there is limited evidence on its impact on bondholders. This paper is to fill this gap by investigating the influences of the price strategy on the bond values in the airline industry during the period from 1984 to 1998. This paper also examines the wealth transfer effect between stockholders and bondholders caused by price changes.

27 - Bound on Expected Objective Value of a Linear Programming with Uncertainty
Phantipa Thipwiwatpotjana, University of Colorado at Denver, Campus Box 170 Campus Box, P.O. Box 173364, Denver, CO, 80217, United States of America, phantipa.thip@ucdenver.edu, Weldon Lodwick

There are three types of uncertainty: probabilistic, possibilistic and interval. We use random set to be a unify approach and generate the corresponding density functions that will be used in the deterministic equivalent stochastic recourse models of a given linear programming model with uncertainty.

28 - A Fuzzy Combinatorial Optimization Model
Elizabeth Untiedt, Graduate Student, University of Colorado Denver, Campus Box 170, P.O. Box 173364, Denver, CO, 80217, United States of America, euntiedt@yahoo.com

Mathematical models of the inherently fuzzy systems in social sciences are well-suited for fuzzy optimization. The present work is a dynamic model for the propagation of West Nile Virus, where the relationships between disease vectors (crows) are fuzzy. The result is a fuzzy combinatorial optimization problem, which, given the source node, predicts the spread of the disease.

29 - Optimal Security Response to Attacks on Open Science Grids
Zhen Xie, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, zhenxie@mcs.anl.gov, Mine Altunay, Sven Leyffer

Cybersecurity is a growing concern, especially in open grids, where attack propagation is easy because of prevalent collaborations among thousands of users and hundreds of institutions. A common concern is that the increased openness may allow malicious attackers to spread more readily around the grid. We present new grid models on how to optimally respond to attacks in open grid environments.

30 - Metamodeling-based Optimization Studies: Simulations and Experiments
Mauricio Cabrera-Rìos, Assistant Professor, University of Puerto Rico at Mayagüez, PO Box 1717, Boqueron, PR, 00622, Puerto Rico, mauricio.cabrera1@upr.edu, Marìa Villarreal, Yareni Lara, Esmeralda Niño-Pérez, Shirley Rojas

Two studies involving the use of a proposed iterative metamodeling-based optimization method are here presented. The first case approaches an injection molding simulation optimization project and is aimed to contrast the use of the iterative method against the use of a single metamodel. The second case uses the method in a small scale experimental optimization task to demnostrate wider applicability. Encouraging results on convergence and quality of solutions are found and discussed.

31 - Introducing Statistic Analysis in Materials Science Projects at Different Points in Time
Mauricio Cabrera, Assistant Professor, University of Puerto Rico at Mayagüez, 250 North Post Road, Mayaguez, PR, 00681, Puerto Rico, applied.optimization@gmail.com, Oscar Chacon, Marcelo Suàrez, Oscar Perales, Yarilìn Cedeño-Mattei, Matilde Sànchez-Peña, Yareni Lara

Four cases in materials science where the use of statistics is introduced at different points in time are presented. The nature and structure of the data, as well as data availability play an important role on determining how to use statistics to achieve results as close as possible to the initial goals of the studies. A taxonomy of situations for materials science laboratories is seeked in this work.

32 - Effects of Donations on Humanitarian Relief Performance: A Simulation Study
Lauren Davis, Assistant Professor, North Carolina A&T State University, 404 McNair Hall, 1601 East Market Street, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu, Daniel Mota

Humanitarian organizations often rely on the contributions of donors to assist in their relief efforts. However, unsolicited donations have the potential to cause bottlenecks in the relief supply chain as resources are diverted to transport and sort through the supplies. We develop a discrete-event simulation model to study the impact of donations on relief performance. We evaluate three coordination strategies and measure the benefit in terms of demand fulfillment and resource utilization.

33 - A New Holistic Method for Complex Network Reliability Approximation & Critical Components Detection
Chi Zhang, Stevens Institute Of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, chi_zhang@live.com, Jose Ramirez-Marquez

Reliability of complex networks is too complex to be analyzed via traditional techniques. A new algorithm (R-Dijkstra) was first proposed to compute the lower bound of two-terminal binary complex network reliability. The problem to detect the critical components of complex networks was then modeled as a multi-objective DNIP and solved by combining R-Dijkstra with MO-PSDA. This new holistic method makes it possible to estimate the reliability of a complex network and find its critical components.

34 - Finite Buffer Fluid Models with Overflow Protection: Applications in Queueing Models
Liqiang Liu, EURANDOM, Eindhoven University of Technology, Netherlands, liu@eurandom.tue.nl

Queueing models with workload-dependent balking has been arising from wide applications such as inventory and service systems (blood bank, call centers, health care etc.) In a queue with workload-dependent balking, an arriving customer joins the queue and stays until served if and only if the system workload is no more than a fixed level at the time of his arrival. The present paper is an extension of our previous work to a more general setting. We begin by considering a fluid model where the buffer content changes at a rate determined by an external stochastic process with finite state space. We derive systems of first-order linear different equations for the mean and LST (Laplace-Stieltjes Transform) of the busy period in this model and solve them explicitly. We obtain the mean and LST of the busy period in the corresponding queueing model as a special limiting case of this fluid model. We demonstrate several applications of our method. We illustrate the results with numerical examples.

35 - Map Segmentation Algorithms for Geographic Resource Allocation
John Carlsson, Assistant Professor, University of Minnesota, Twin Cities, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, jcarlsso@umn.edu

In a wide variety of practical problems, a geographic region must be segmented into smaller regions to allocate resources "fairly". This is often done using combinatorial devices that discard the underlying geometry of the problem. In this session we describe a geometric framework, map segmentation, for solving such problems and give several examples demonstrating the effectiveness of such approaches.

36 - Decision Support System at AMD: OARS
Mehmet Candas, AMD, 5604 Southwest Pkwy, Austin, TX, 78735, United States of America, Mehmet.Candas@amd.com

The decisions support system Optimal Alignment and Review Systems is Advanced Micro Devices' tool for production planning in the extended AMD supply chain network that encompasses AMD owned production facilities and a collection of vendors contracted for production support and services in various geographies. The global macro production network consists of transportation links and production or processing nodes, with overlapping or distinct capabilities for capacity and multi-provisioning capabilities. While the primary objective of the problem is just in time fulfillment of demand, managing the product and process choices in manner which minimizes the amount of unusable by-products and levels of downgrading is a primary metric of solution quality within the applicable constraints. The biggest challenge in OARS project is to manage the size of the problem, considering millions of variables and constraints. We applied several segmentation strategies with multi-pass iterative solution processes, data pruning algorithms, pre-processing and post-processing methods to overcome this challenge.

37 - Workload Crisis Management in Knowledge-Based Service Systems
Yao Cheng, Northwestern University, 2121 Orrington Ave, Evanston, IL, 60201, United States of America, yaocheng2009@u.northwestern.edu, Wallace Hopp, Seyed Iravani

We propose a novel approach to model knowledge ñ assessment ñ decision process in hierarchically structured service systems that rely heavily on their agents' knowledge. We are able to show the decision properties under different assumptions, and to characterize the structural ability of such knowledge-based service systems to respond effectively to workload crisis.

38 - Informational Social Influences on B2C E-commerce Websites
Lih-Bin Oh, Assistant Professor, Xi'an Jiaotong University, 28 Xianning Xilu, Xi'an, China, ohlb@mail.xjtu.edu.cn

This study examines the persuasive social influence impacts of two forms of interpersonal information sources, namely third-party expert reviews and consumer-to-consumer electronic word-of-mouth (e-WOM) on B2C e-commerce Websites. Drawing upon persuasive argument theory and information integration theory, a laboratory experiment was designed to examine the impacts of message sidedness of third-party expert review and the valence of e-WOM.

Monday, 1:30pm - 3:00pm

■ MC01

C-Room 21, Upper Level

Joint Session DA/ MAS: Military Decision Analysis

Sponsor: Decision Analysis & Military Applications
Sponsored Session

Chair: Greg Parnell, United States Military Academy, Dept of Systems Engineering, West Point, NY, 10996, United States of America, Gregory.Parnell@usma.edu

1 - Risk Profiles and Rank Sensitivity in the Selection of a Course of Action in Stability Operations
Jeffery Weir, Associate Professor, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, jweir@afit.edu, Mary Sanders, Alex Gutman

Multi Objective Decision Analysis is a vital tool that can aid decision makers and take into account uncertainty and the effect of such on the ranking of Courses of Action. This research develops a framework for generating risk profiles as well as rank sensitivity charts to aid decision makers in course of action selection. An

example will be shown using stabilization operations in Iraq. This research is in support of the Air Force Research Laboratory's Commander's Predictive Environment.

2 - Assessing Progress in Counterinsurgency Operations
Paul Kucik, Academy Professor, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States of America, paul.kucik@usma.edu

In a counterinsurgency campaign, organizations develop strategic level assessments to measure progress towards goals and to inform resource allocation and policy decisions. Because insurgency is a complex, multi-disciplinary problem whose characteristics vary from one locality to the next, there are inherent challenges to developing assessments and recommendations for use at the strategic level. This presentation addresses those challenges and outlines possible solution approaches.

3 - Towards Blue Horizons
Greg Parnell, United States Military Academy, Dept of Systems Engineering, West Point, NY, 10996, United States of America, Gregory.Parnell@usma.edu

The Air Force Blue Horizons study used alternate futures and value-focused thinking to assess the future value of 58 future system concepts and 172 key enabling technologies. We describe the four scenarios and the decision analysis models. We highlight key conclusions and recommendations on how the Air Force should best prepare for such disparate potential challenges as rising peer competitors, the problem of failed states and continued insurgencies in far-flung parts of the world.

4 - Decision-focused Thinking: Early Successes and a Software Tool
Rob Dees, Analyst/Instructor, Department of Systems Engineering, United States Military Academy, US Army, Fourth Floor Mail Room, BLDG 752, Mahan Hall, West Point, NY, 10996, United States of America, rob.dees@us.army.mil, Alex MacCalman, Matt Dabkowski

At INFORMS 2008, we introduced Decision-Focused Thinking(DFT). At decision time, DFT eliminates common and unavailable value from a Value-Focused Thinking(VFT) model and showcases the value-based, alternative-refined, decision-relevant differences among the alternatives, thereby increasing understanding and commitment to action. In this presentation, we summarize early successes from practice with DFT and provide a preliminary software tool to automate the transformation and display of results.

■ MC02

C-Room 22, Upper Level

Behavioral Decision Making

Sponsor: Decision Analysis
Sponsored Session

Chair: Cade Massey, Asst Prof of Organizational Behavior, Yale University, School of Management, 135 Prospect St., New Haven, CT, 06511, United States of America, cade.massey@yale.edu

1 - Varieties of Loss Aversion and the Uncertainty Effect
Yuval Rottenstreich, Assc Prof of Management and Organizations, New York University, Stern School of Business, 40 West 4th St, #429, New York, NY, 10012, United States of America, yuval@stern.nyu.edu, Jeff Galak, Alex Markle

Uncertain prospect are often valued lower than their worst outcome. Such "Uncertainty Effects" may reflect loss aversion. Exchange loss aversion (ELA) arises when a sure thing is given up for another. Prospect loss aversion (PLA) arises when a sure thing is given up for a prospect. PLA > ELA implies uncertainty effects. We have subjects provide willingness-to-pay or certainty equivalents (only the former implicates loss aversion). We find Uncertainty Effects for WTP but not CE.

2 - Myopic Loss Probability Aversion
Thomas Langer, University of Muenster, Münster, D-48149, Germany, Thomas.Langer@wiwi.uni-muenster.de

For loss averse investors, a sequence of risky investments looks less attractive when evaluated myopically - an effect called myopic loss aversion (MLA). The phenomenon has been confirmed in several experimental studies. However, by the construction of the lotteries none of these studies can distinguish between MLA and an alternative explanation, myopic loss probability aversion (MLPA). We present the results of an experimental study that allows to disentangle these competing explanations.

3 - Keeping the Faith: Optimism in the Face of Feedback
Cade Massey, Asst Prof of Organizational Behavior, Yale University, School of Management, 135 Prospect St., New Haven, CT, 06511, United States of America, cade.massey@yale.edu, Joseph Simmons, David Armor

Does optimism persist in the face of feedback? To investigate we asked NFL fans to predict outcomes during each week of the football season. Participants were optimistic before the season began, predicting their favorite team would perform much better than did neutral parties. This optimism was very robust, persisting until the season's final weeks. By comparing our participants' responses to publicly traded prediction markets, we identify the critical role desirability plays in this bias.

■ MC03

C-Room 23A, Upper Level

Multicriteria Decision Making

Contributed Session

Chair: Jie Yu, Assistant Research Scientist, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States of America, yujie@umd.edu

1 - A Sequencing Model for Clients of a Liquefied Petroleum Gas Distribution Unit
Adiel Almeida-Filho, Assistant Professor, Federal University of Pernambuco, Rua da Hora, 593, Apto. B21, Espinheiro, Recife, PE, 52020-010, Brazil, atalmeidafilho@yahoo.com.br, Ana Paula Costa, Marcos Sobral

This work presents the context of a case study for this problem of sequencing clients using MCDA to consider traditional sequencing criteria and also strategic criteria which will refer specifically to the case study context, such as risk of lacks of gas in a specific region, distance between distribution unit and client last destiny and technical aspects of the operation.

2 - Student Project Allocation Using Goal Programming
Sydney Chu, Professor, University of Hong Kong, Department of Mathematics, Hong Kong, Hong Kong - ROC, schu@hku.hk

The student project allocation (SPA) problem assigns a list of projects to students with prerequisites. Students indicate preferences over eligible projects, while Department wishes to make the most allocations, with preferences for students of higher GPAs. These features lead naturally to a pre-emptive GP formulation, which generalizes from the typically single-objective SPA problems. A set of real data illustrates the effectiveness of its DSS implementation.

3 - Evaluating HCW Disposal Alternatives Using A Fuzzy Multi-criteria Decision Making Approach
Melis Almula KARADAYI, Galatasaray University, Ciragan Street No: 36 34357 Ortakoy, Istanbul, Turkey, melisalmula.sye@gmail.com

This paper presents a hierarchical distance-based fuzzy multi-criteria decision making framework for evaluating health-care waste (HCW) disposal alternatives for Istanbul, including "incineration"steam sterilization","microwave" and "landfill". Economic, environmental, technical and social criteria and their related sub-criteria, which incorporate both quantitative and qualitative data, are employed to evaluate health-care waste dipsosal alternatives.

4 - Flexible Flowshop Scheduling with Machine Skipping
Rasaratnam Logendran, Professor, Oregon State University, School of Mech., Indust.&Mfgr. Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, Logen.Logendran@oregonstate.edu, Vaibhav Pandya

We propose a methodology for minimizing the total weighted tardiness of jobs that are dynamically released in a flexible flowshop, with the possibility of machine skipping. Sequence dependent set-up of machines along with dynamic machine availabilities, further add to the complexity of the problem. The use of a tabu search-based heuristic algorithm for efficiently obtaining high quality solutions is demonstrated on an example problem.

5 - A Multi-criteria Approach for Prioritizing Traffic Safety Improvement Projects
Jie Yu, Assistant Research Scientist, University of Maryland, Department of Civil Engineering, College Park, MD, 20742, United States of America, yujie@umd.edu, Yue Liu, Gang-Len Chang

This paper presents a multi-criteria approach for prioritizing traffic safety improvement projects, in which a set of criteria are selected to account for the impacts of technical, economic, and social related contributory factors. Results from a case study reveal that the proposed model is quite promising. Comparative study between the proposed and the existing methods has also been done to assist safety project managers in best understanding the unique features of the proposed model.

■ MC04

C-Room 23B, Upper Level

Online Auctions - Theory and Evidence

Cluster: Auctions
Invited Session

Chair: Wedad Elmaghraby, University of Maryland, R.H. Smith School of Business, College Park, MD, United State of America, Wedad_Elmaghraby@rhsmith.umd.edu

Co-Chair: Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@uiuc.edu

Co-Chair: Peter Popkowski Leszczyc, ppopkows@ualberta.ca

1 - Simultaneous Auctions by Sellers of Different Reputations: Theory and Experimental Evidence
Sarah Rice, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road, Unit 1041A, Storrs, CT, 06269, United States of America, sarah.rice@business.uconn.edu, Chris Dellarocas, Ravi Bapna

We study settings where vertically differentiated sellers (e.g. sellers of different reputations for honesty) simultaneously offer sealed-bid, second-price, single-unit auctions for identical goods to unit-demand buyers. Vertical differentiation is a salient but understudied aspect of wide range of simultaneous auction settings. We test our theoretical propositions in a controlled laboratory experiment with induced values.

2 - Optimal Auctioneer Fee Policy
Justin Jia, Penn State University, 483A Business Building, University Park, PA, 16802, United States of America, zuj100@psu.edu

In an online eBay-like auction, an auctioneer provides a platform for sellers to hold auctions and collects fees from them. The auctioneer and the sellers are not in the same revenue maximization party, as often assumed by classical auction theory. We formulate the problem as a Stackelberg game with a monopolistic auctioneer and a private-type seller, develop subgame perfect equilibria, and show that under certain conditions the auctioneer may use simple-form fees to achieve the best outcome.

3 - Measuring Risk Aversion in a Name-Your-Own-Price Channel
Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61821, United States of America, aliabbas@illinois.edu, Il-Horn Hann

We measure the risk aversion coefficients exhibited by online bidders in a Name-Your Own Price (NYOP) intermediary. We present a decision analytic model for the optimal bidding sequence and relate the increments in each two successive bids to the bidders' risk aversion coefficient. We then use field data from an NYOP firm to estimate the exhibited risk aversion. Based on three different product groups, we find that that bidders exhibit relatively high risk aversion on internet sites.

4 - Jump Bidding in Online Auctions: A Double-Edged Sword
Peter Popkowski Leszczyc, University of Alberta, Edmonton, AB, Canada, ppopkows@ualberta.ca, Yongfu He

We develop a conceptual model of the opposing effects of jump bidding in online auctions. On the one hand, it may lead to reduced competition, by deterring bidder entry or discouraging continued bidding; leading to lower prices. On the other hand, it may signal a bidder's strength and/or high valuation, increasing willingness to pay (WTP). Results of two laboratory studies find support that jump bidding has both a deterrence of entry effect and a positive effect on bidders' WTP.

■ MC05

C-Room 23C, Upper Level

Panel Discussion: Research Issues and Opportunities in Homeland Security

Sponsor: Quality, Statistics and Reliability
Sponsored Session

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

Co-Chair: Gary Gaukler, TAMU, TAMU-3131, College Station, United States of America, gaukler@tamu.edu

1 - Research Issues and Opportunities in Homeland Security
Panelists: Henry H Willis, David Morton, Tayfur Altiok, Wilbert Wilhelm

A panel of leading researchers in the area of homeland security will discuss the current practice, research challenges and opportunities, and future directions in the field. In particular, the panel discussion will highlight how OR methodologies can affect policy making and contribute to making our nation safer. The panel members' expertise covers a wide range, from nuclear smuggling interdiction, port security, and sensor location optimization, to maritime security policy and risk analysis.

■ MC06

C-Room 24A, Upper Level

Quality and Statistical Decision Making in Health Care Applications II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing LiAssistant Professor, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, huiyang@eng.usf.edu

1 - Do Better Quality Hospitals Result in Better Patient Satisfaction and Recommendation Ratings?
Jiban Khuntia, PhD Student, Robert H. Smith School of Business, 4360 CHIDS Van Munching Hall, University of Maryland, College Park, MD, 20783, United States of America, jiban@umd.edu, Mahesh Kumar, Ritu Agarwal

This study investigates the effect of quality, technology capacity and staffing on patient satisfaction and recommendation ratings for hospitals. Using linear regression on data collected from 181 hospitals in California, we found that hospital's income and doctor-to-nurse ratio have positive impact on hospital ratings, whereas quality and technology capacity impacts are insignificant.

2 - The Impact of Clinical Documentation System: A Routines Perspective
Jie Mein Goh, University of Maryland, 3330 Van Munching Hall, Robert H Smith School of Business, College Park, MD, 20742, United States of America, jgoh@rhsmith.umd.edu, Ritu Agarwal, Gordon Gao

With the broad consensus on the potential benefits electronic medical records (EMR), the number of hospitals adopting EMR is expected to rise dramatically. Yet the uptake of EMR lags far behind these expectations. Less than 2 percent of the acute care hospitals in a recent survey have comprehensive EMR. Using a field study, we explore the impact of clinical documentation, a specific component of comprehensive EMR, in a pediatrics hospital. We present ways through which change to routines occur.

3 - Phase I Analysis for Performance Monitoring in Healthcare
Li Zeng, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, LZENG1@WISC.EDU, Shiyu Zhou

Outcomes in medical processes are important measures of care provider's performance. One key challenge in performance monitoring using outcomes is the need of adjustment for patient base-line risks. This study considers the Phase I analysis in risk-adjusted performance monitoring, which aims at identifying data from in-control process so that a reference can be established for future monitoring.

4 - Identification of Patient Recovery Patterns after Cardiac Surgery based on Laboratory Tests Results
Alcides Santander, USF - UniNorte, 4202 E Fowler Ave, ENB 118 - Industrial Eng. Department, Tampa, Fl, 33620, United States of America, asantand@mail.usf.edu, Jose Zayas-Castro, Peter Fabri, Ramzi Sinokrot

The aims of this research are to develop a comprehensive methodology for the analysis of laboratory test results to effectively monitor patient recovery process after undergoing cardiac surgery procedures. Time series clustering methods are applied to identify different patient recovery patterns that allow the detection of hidden interactions among different indicators of patient health condition and early identification of possible complications during patients' recovery.

■ MC07

C-Room 24B, Upper Level

Reliability Analysis for Design

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Martin WortmanProfessor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

1 - Reliability Modeling Supporting Decision-Based Design
Martin Wortman, Professor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

Reliability modeling finds one of its principal applications in the support of engineering design activity. Simulation has largely replaced operational prototyping of candidate designs; hence, reliability modeling of design alternatives is no longer driven by laboratory test-data. We offer a risk-based approach for determining when it is possible to identify the "most perferred" design alternative when reliability laws are difficulty to accurately capture.

2 - New Birnbaum Importance-based Heuristics for Solving Component Assignment Problems
Qingzhu Yao, University of Tennessee, 305 East Stadium Hall, Knoxville, TN, 37996, United States of America, qyao@utk.edu, Xiaoyan Zhu, Way Kuo

Given a system and a set of components with different reliabilities, the component assignment problem is to find an optimal arrangement of the components to the positions of the system so that the system reliability is maximized. Five new heuristics based on the Birnbaum importance are proposed and their properties are presented. Our extensive numerical tests demonstrate the effectiveness of the new heuristics. Finally, the suggestions on selecting appropriate heuristics for the CAP are made.

3 - Monitoring High-Dimensional Processes Using A Wavelet-Based Distribution-Free Tabular CUSUM Chart
Joongsup (Jay) Lee, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, gth689p@mail.gatech.edu, Seong-Hee Kim, James R. Wilson, Youngmi Hur

We formulate and evaluate WDFTC, a wavelet-based distribution-free tabular CUSUM procedure for detecting shifts in the mean of a high-dimensional process. We calculate the monitoring item from the discrete wavelet transform of the original process and apply the distribution-free CUSUM chart. Experimental results show that WDFTC outperforms existing multivariate process control charts in various types of multivariate test processes, including those with nonnormal marginals.

■ MC08

C-Room 24C, Upper Level

Applied Analysis of Patterns in Multi-source and Multivariate Data

Sponsor: Data Mining
Sponsored Session

Chair: Artur Dubrawski, Adjunct Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awd@cs.cmu.edu

1 - Integrating Experts Capabilities into Biosurveillance Systems
Taha Kass-Hout, Director, Global Public Health and Informatics, InSTEDD, 3303 Flowers Road South, #Q, Atlanta, GA, 30341, United States of America, kasshout@gmail.com

Over the last decade, the majority of the designs, analyses and evaluations of biosurveillance systems have been geared towards specific data sources and detection algorithms. Much less effort has been focused on how these systems will "interact" with humans. Our approach is designed to streamline the collaboration between domain experts and machine learning algorithms for detection, prediction and response to health-related events (such as a disease outbreaks or a pandemic).

2 - Network Analysis in Food Safety Investigations
Mark Huckabee, huckabeem@saic.com, Artur Dubrawski, Lynda Kelley, Karen Chen, Adrienne Dunham

In Food Safety Investigations, data such as sales receipts, shipping records, logs, and invoices, is being successively collected from multiple sources. Quickly understanding patterns in such data is a challenge for investigators. Our team has proposed the use of entity-link networks to represent the complex relationships among the products and manufacturers. Network-based visualizations and analyses improve understanding of data and allow investigators to more rapidly discover critical links.

3 - Recognizing Appliance-specific Patterns in Multivariate Time Series of Power-metrics From a Building
Mario Berges, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, marioberges@cmu.edu, Lucio Soibelman, Ethan Goldman, H. Scott Matthews

In this talk we will present different techniques for detecting and correctly identifying state-transitions for individual appliances in a building (e.g., a light-bulb going from state "off" to state "on"), by inspecting the overall voltage and current signals for the building's electrical distribution system. Specifically, we analyze estimates of the spectral envelope coefficients and explore how different statistical and machine learning tools can be applied to solve the problem.

4 - Adaptive Models for Recognition of Events in Temporal Data
Sajid Siddiqi, PhD Student, Carnegie Mellon University, NSH 3122, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, siddiqi@cs.cmu.edu, Artur Dubrawski, Abhishek Sharma, Julian Ramos

We describe a successful application of statistical machine learning to the problem of recognizing disparate events in time series. We use STACS, a state-of-the-art adaptive technique for learning Hidden Markov Model size and parameters. The trained models can reliably isolate events of various types in for instance acoustic recordings (such as human speech, animal sounds, vehicular noise, explosions, etc). It can also simultaneously handle data from multiple sensing modalities.

■ MC09

C-Room 25A, Upper Level

The Applied Probability Society Markov Lecture

Sponsor: Applied Probability
Sponsored Session

Chair: John Tsitsiklis, MIT, 77 Massachusetts Ave., Cambridge, MA, United States of America, jnt@mit.edu

1 - Information Aggregation and Consensus in Networks
John Tsitsiklis, MIT, 77 Massachusetts Ave., Cambridge, MA, United States of America, jnt@mit.edu

A primary function of many engineered and social networks is to aggregate the information obtained by the nodes of a network. We discuss a few of the models and thrusts that have been studied, starting with a model of "social learning" by rational (Bayesian) agents, and its connections with information fusion models in the engineering literature. We then consider a set of agents (processors, decision makers, sensors, etc.) who reach consensus through an iterative process involving the exchange and averaging of local values. We discuss a number of models, application contexts, and convergence results, and the connections with Markov chain theory.

■ MC10

C-Room 25B, Upper Level

Statistics

Contributed Session

Chair: Genady Grabarnik, Scientist, Ritesoft, 126 Brambach Rd, Hawthorne, NY, 10532, United States of America, genadyg@gmail.com

1 - Relationships Among Univariate Distributions
Yichun Chen, PhD Student, National Tsing Hua University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan - ROC, d937817@oz.nthu.edu.tw, Wheyming Song

This paper presents a user friendly display, in a matrix format, of a collection of 80 univariate distributions and their interrelationships. A simplified seven-by-five matrix, showing only 25 families, is designed for student use. These relationships provide rapid access to information that must otherwise be found from a time-consuming search of numerous sources.

2 - Comparison Assessment of Customer Associate Group Operation
Genady Grabarnik, Scientist, Ritesoft, 126 Brambach Rd, Hawthorne, NY, 10532, United States of America, genadyg@gmail.com, Yefim Michlin, Larisa Shwartz

Companies in the field of information technologies are characterized by high dynamicity in composition and profile of the customer associate groups. Assessment of the operation quality of these groups is a major factor in managing the communication process with the customers, and as such largely determines the company's success. The present study proposes a truncated sequential probability ratio test for the purpose in question.

■ MC12

C-Room 26A, Upper Level

Computational OR in Chronic Diseases

Sponsor: Computing Society
Sponsored Session

Chair: Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu

1 - Factor Screening: An Alternative Approach for Sensitivity Analysis

Reza Yaesoubi, PhD Candidate, North Carolina State University, Campus Box 7906, 421 Daniels Hall, Raleigh, NC, 27511, United States of America, ryaesou@ncsu.edu, Stephen Roberts

Factor screening experiments systematically examine the input factors of a model to identify those factors with significant effect on a selected output. We discuss how factor screening experiments can be employed as an alternative for sensitivity analysis. The advantages over traditional one- and multiple-way sensitivity analyses will be discussed. We will also review a number of available factor screening methods and present the results of applying them to a medical decision-making model.

2 - Optimizing the Timing of Statins for Patients with Uncertain Adherence

Jennifer Mason, N.C. State University, 375 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27613, United States of America, jemason2@ncsu.edu, Brian Denton, Steven Smith, Nilay Shah, Darin England

Statins are effective in reducing cholesterol, a primary risk factor for cardiovascular disease. However, patients who are prescribed statins often stop taking the drug altogether or take less than the prescribed amount, lowering the drug's benefit. We discuss an MDP model to optimize the treatment decision for hypercholesterolemia in the presence of uncertain future adherence. We present results for optimal policies in the presence of adherence improvement programs.

3 - Using POMDPs to Determine the Optimal Mammography Screening Schedule From the Patient's Perspective

Turgay Ayer, University of Wisconsin, 1513 University Ave., Madison, WI, 53708, United States of America, tayer@wisc.edu, Oguzhan Alagoz, Natasha Stout

Breast cancer is the second leading cause of cancer death among U.S. women. Mammography is the most common screening tool for breast cancer, yet there is no agreement over the optimal timing and screening frequency of mammography examinations. We develop a partially observable Markov decision process (POMDP) model for optimal mammography screening schedule from the patient's perspective. We derive several structural properties of the POMDP model. We optimally solve this POMDP using real data.

4 - Using Dynamic Models to Determine When to Stop Catch-Up Vaccination for Hepatitis B

David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

Hepatitis B is a vaccine-preventable chronic viral disease. In many locales, newborn vaccination for Hepatitis B is becoming widespread and officials are promoting catch-up vaccination programs as cost-effective public health interventions. Yet, due to increasing vaccination, infection incidence is slowly falling. We use models of disease transmission and progression to estimate how long these catch-up vaccination programs will remain cost-effective.

■ MC13

C-Room 26B, Upper Level

COIN-OR Open-Source Technology and Applications

Sponsor: Computing Society
Sponsored Session

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

1 - How COIN-OR is Helping Amadeus to Enhance Critical Applications

Daniel Perez, Amadeus, 485 Route Pin Montard, Sophia Antipolis, 06560, France, daniel.perez@amadeus.com

Amadeus is a leading company in the travel distribution market offering highly available and performing systems for critical missions. In such a demanding environment, the highest standards are required for any component to be ready for production. An application for airline operations using BCP has benefited from COIN-OR's multi-solver capability and modular framework. The benefits will be presented as well as lessons learned which could help to enhance COIN-OR.

2 - New CoinMP Release 1.5: A Simple C-API Windows DLL and Unix Solver Library (LP/MIP) Based on COIN

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

The COIN Open Source Initiative has become very popular in the recent years. To make life easier for users that simply want to solve models and not compile C++ applications, we have developed a standard C-API Windows DLL CoinMP.DLL that implements most of the functionality of CLP, CBC, and CGL. A Linux/Unix version using AutoMake is also available.

3 - Using CHiPPS for Parallel Solution of Generic Integer Programs

Ted Ralphs, Lehigh University, ISE, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Yan Xu, Laszlo Ladanyi, Matthew Saltzman

In this talk, we discuss the application of the CHiPPS parallel search framework, which was designed specifically with support for the implementation of relaxation-based branch-and-bound algorithms in mind, to address the challenges that arise in parallelizing the branch-and-cut algorithm for solving generic mixed integer linear programs. We present computational results that illustrate the scalability of our approach and the tradeoffs inherent in parallelizing branch and cut.

4 - Modeling Cone Optimization Problems with COIN OS

Imre Polik, Visiting Assistant Professor, Lehigh University, Department of Industrial and Systems Engineering, 200 West Packer Avenue, Bethelehem, PA, 18015, United States of America, imre@polik.net, Jun Ma, Kipp Martin, Horand Gassman

We present a new modelling extension of the popular COIN OS, to model cone optimization problems. Not only this extension is able to represent a wide range of optimization problems, but it can also capture the special structure of them. This is crucial, since it enables the solvers to exploit these special structures to speed up the computation or to improve accuracy. This is joint work with Jun Ma, Kipp Martin and Horand Gassman.

■ MC14

C-Room 27A, Upper Level

Software for OR/MS III

Sponsor: Computing Society
Sponsored Session

Chair: Daniel Fylstra, President, Frontline Systems Inc., 913 Tahoe Blvd., #7, Incline Village, NV, 89450, United States of America, dfylstra@frontsys.com

1 - How to Assure a Successful OR Roll-out Using AIMMS?

Gertjan De Lange, AIMMS (Paragon Decision Technology), 5400 Carillon Point, Kirkland, WA, 98033, United States of America, Gertjan.de.Lange@aimms.com

How are you going to assure that the OR models you made and worked so hard on are actually used? Moreover, that they generate expected benefits and advance the organization continuously? This demo will focus on the ability to create and deploy OR into any organization using AIMMS. Based on real-life practices (i.e. AIMMS solutions used in businesses every day throughout the world), we will show you how to be successful from start to finish and cover all aspects of an OR roll-out.

2 - Pythagoras: An Agent-Based Model

Donna Middleton, Operations Research Analyst, Northrop Grumman, 12900 Federal Systems Park Drive, FP1/3122P, Fairfax, VA, 22033, United States of America, Donna.Middleton@ngc.com

Pythagoras is a modeling environment, providing the user with a host of capabilities, rules and behaviors to describe an agent. Pythagoras includes soft decision rules, dynamic sidedness and behavior-change triggers. Soft decision rules create instances of agents whose behaviors can be unique to the agent. Dynamic sidedness allows agents to change sides as a function of events and actions. Behavior-change triggers allow agents to change their behavior as a function of events or actions.

3 - Extending Stochastic AMPL to Represent Chance Constrained and Robust Optimization Problems

Christian Valente, CARISMA, Brunel University, Kingston Lane, Uxbridge, UB8 3PH, United Kingdom, Christian.Valente@brunel.ac.uk, Viktar Zviarovich, Gautam Mitra

We propose extensions to AMPL modelling language to include chance constraints, integrated chance constraints, and robust optimization problems. This follows our earlier work on Stochastic AMPL (SAMPL) for scenario-based stochastic programming problems. We discuss the motivation, design issues and advantages of adding these extensions both from modelling and solution perspectives. We describe the implementation with examples of these new features in the SAMPL translator.

4 - Integrating Optimization, Simulation, and More in Risk Solver Platform for Excel
Daniel Fylstra, President, Frontline Systems Inc., 913 Tahoe Blvd., #7, Incline Village, NV, 89450, United States of America, dfylstra@frontsys.com

Risk Solver Platform for Excel is integrated software for Monte Carlo simulation, conventional optimization (upward compatible from the Excel Solver), stochastic optimization, and other decision models. With a unified user interface for building both optimization and simulation models, it aims to simplify learning, teaching, and use by non-specialists. It handles very large industrial models with excellent performance, makes maximum use of multi-core PCs, and supports 12 different Solvers.

■ MC15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - LINDO Systems, Inc. - Optimization Modeling Made Easy
Mark Wiley, LINDO Systems, Inc., 1415 North Dayton Street, Chicago, IL, 60622, United States of America, mwiley@lindo.com

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

2 - IBM ILOG CPLEX 12 Technology Update
John Gregory, ILOG CPLEX Product Manager, IBM ILOG Optimization, 889 Alder, Suite 200, Incline Village, NV, 89451, United States of America, jgregor@us.ibm.com

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

■ MC16

C-Room 28A, Upper Level

Informational Impacts of the Internet

Sponsor: Information Systems
Sponsored Session

Chair: Nelson Granados, Assistant Professor of Information Systems, Graziadio School of Business, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu

1 - Product Uncertainty in Electronic Markets: Insights From eBay's Used Car Auctions
Paul Pavlou, paul.pavlou@temple.edu, Angelika Dimoka

The Internet interface poses a difficulty for buyers in evaluating products online, particularly experience goods, such as used cars. This increases product uncertainty, the buyer's estimate of the variance in product quality. However, the literature has ignored product uncertainty and focused on seller uncertainty. To address this void, this study examines the nature, effects, and antecedents of product uncertainty in online auctions for used cars.

2 - Measuring the Information in Information Work
James Short, Research Director, UC San Diego, 9500 Gilman #0519, La Jolla, CA, 92093, jshort@ucsd.edu, Adam Saunders

The growth of information workers in the US economy has been well documented. Wolff (2005) found that information workers increased from 37% of the work force in 1950 to 59% in 2000, to 63% in 2008. This session will present research on measuring the information in "information work". We will cover: (1) definitions of information (2) measuring information in the workplace (3) preliminary results (4) implications and future research.

3 - How Much Information? A Census of the Worlds' Data and Information
Roger Bohn, Professor, UC San Diego, 9500 Gilman Drive, San Diego, CA, 92122, United States of America, rbohn@ucsd.edu, James Short

The How Much Information (HMI?) research project is creating a 'census' of the worlds data and information for 2008. We depart from past measurements by attempting to count all data and information, including data generated by and for machines, and transient data that is created and thrown away, rather than being stored. We use bytes, words (Pool 1984), or hours as metrics. They give different implications about growth rates and relative importance of different kinds of information.

4 - Online Strategies for Information Age: Information Transparency in Business-To-Consumer Markets
Nelson Granados, Assistant Professor of Information Systems, Graziadio School of Business, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu, Alok Gupta, Robert Kauffman

The Internet increasingly enables firms to use information strategically by designing transparent, biased, distorted, and opaque selling mechanisms. However, the research on this topic is scarce and scattered across academic disciplines. We develop a research framework and a research agenda on the emerging and increasingly important topic of transparency strategy, which we define as the set of policies and decisions that a firm makes to disclose, bias, distort, or conceal market information.

■ MC17

C-Room 28B, Upper Level

New Models for eBusiness Channels and Online Product Review

Sponsor: e-Business
Sponsored Session

Chair: Daewon Sun, University of Notre Dame, 359 Mendoza CoB, Notre Dame, IN, 46556, United States of America, dsun@nd.edu

1 - Coordinating a Supply Chain with a Manufacturer-Owned Online Channel
Daewon Sun, University of Notre Dame, 359 Mendoza CoB, Notre Dame, IN, 46556, United States of America, dsun@nd.edu, Xuying Zhao, Jennifer Ryan

We consider a dual channel supply chain in which a manufacturer sells a single product to end-users through both a traditional retail channel and a manufacturer-owned direct online channel. We model each channel as a newsvendor problem, with price and order quantity as decision variables. In addition, the manufacturer must choose the wholesale price to charge to the independent retailer.

2 - The Effect of List Price on Channel Performance in a Revenue-sharing Contract
Jun Ru, PhD Candidate, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, jun.ru@utdallas.edu, Xiangpei Hu, Yunzeng Wang

Amazon.com, the leading online retailer, has designed a unique contract, called the Advantage Program, for managing its business relationship with suppliers. An important parameter in the contract is a list price that a supplier is allowed to choose for its product. We build a game theoretic model to show that supplier's list price acting as a constraint on retailer's retail price in the contract plays a major role in determining firms' decision and performance in equilibrium.

3 - Competing for Attention: An Empirical Study of the Strategic Behaviors of Online Reviewers
Wenqi Shen, Purdue University, 100 S. Grant Street, West Lafayette, IN, 47907, United States of America, shenw@purdue.edu, Yu Jeffrey Hu, Jacquelyn M. Rees

This study focuses on how online reviewers compete for the scarce resource, users' attention. We theorize the strategies that online reviewers could adopt to gain optimal attention under different conditions, such as the crowdedness of the review segment and the reviewer's reputation level. We found that reviewers would strategically choose different strategies in terms of choosing popular or unpopular books and posting extreme or moderate ratings under different conditions.

4 - Online Content Search and Creation Behavior Using Mobile Digital Media
Anindya Ghose, Assistant Professor, NYU Stern, 44 West 4th Street, New York, United States of America, aghose@stern.nyu.edu, Sang Pil Han

As mobile commerce becomes increasingly popular, newer strategies for mobile-based advertising and marketing may need to be implemented in this environment, in addition to or in lieu of, traditional internet marketing methods. Using both vector autoregressive and simultaneous equations models, we empirically estimate how content creation by users is related to their content usage in mobile media, and how these processes are related to the behavior of their social networks.

■ MC18

C-Room 28C, Upper Level

Advances in Computational Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Daniel Bienstock, Columbia University, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu

1 - Disjunctive Strong Branching Inequalities for Mixed Integer Nonlinear Programming (MINLP)

Mustafa Kilinc, Graduate Student, University of Wisconsin, 3226 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, kilinc@wisc.edu, Jeff Linderoth, Jim Luedtke, Andrew Miller

Strong Branching is an effective technique that can significantly reduce the size of branch-and-bound tree. We use "discarded" information from strong branching to create disjunctive cutting planes for convex MINLPs. These cuts can be strengthened by using optimality conditions and further by integrality of discrete variables. We show how Mixed Integer Rounding (MIR) and Mixing can be applied to Strong Branching Cuts. Computational results reveal that these inequalities might be effective.

2 - Approximating MINLP through Piecewise Linear Optimization

Ismael de Farias, Associate Professor, Texas Tech University, Lubbock, TX, 79409, ismael.de-farias@ttu.edu

We present a branch-and-cut strategy to solve mixed-integer nonlinear programming (MINLP) by approximating it as a piecewise linear optimizaiton problem (PLO). We make no assumptions on whether the nonlinear funcion is convex or not. We show how to derive new and efficient cutting planes for the PLO set, and we extend our results to the case where PLO includes a number of combinatorial constraints that often arise in MINLP.

3 - A New LP Algorithm for Precedence Constrained Production Scheduling

Mark Zuckerberg, BHP Billiton, Melbourne, Australia, Mark.Zuckerberg@bhpbilliton.com, Daniel Bienstock

We present a new iterative lagrangian-based algorithm for solving the LP relaxation of precedence constrained production scheduling problems as they occur in various industries. The algorithm can be proven to converge, and in practice we have found that even for problems with millions of variables and tens of millions of constraints, convergance is usually obtained in under 20 iterations, with each iteration requiring only a few seconds to solve with current computer hardware.

■ MC19

C-Room 28D, Upper Level

OD Estimation and DTA Model Calibration

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu

1 - Estimation of Network Origin-Destination Matrices Using Partial Link Traffic Flow Information

Shou-Ren Hu, Assistant Professor, National Cheng Kung University, No. 1, University Road, Tainan City, 70101, Taiwan - ROC, shouren@mail.ncku.edu.tw, Han-Tsung Liou, Srinivas Peeta

Inferring trip origin-destination (O-D) matrix in a vehicular network using partial link flow information is a crucial component for transportation planning and traffic management. Given the network structure, this study, addressed from a budgetary planning perspective, seeks to estimate a desirable network O-D matrix for network management purposes. A pseudo-inverse matrix method is proposed to solve the network O-D demand problem in an under-determined system.

2 - Origin-Destination and Speed Profile Calibration for Dynamic Traffic Assignment Models

Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Jorge Villalobos, Yang Gao

Most existing DTA calibration procedures focuses on origin-destination calibration with the goal of minimizing link count deviations without considering the situation in which the count may be resulted from either congested or free-flow conditions. We presented an integrated calibration methodology that optimizes the matching of both OD volumes and speed profiles through one-norm linearization of the least-square formulation and construction of demand curves.

3 - Estimation of Time-dependent OD Matrices Using Patial Static and Partial Dynamic Link Flow Data

Xiaoquan Liu, Rensselaer Polytechnic Inst., 2430 Bldg, 21st Street, Apt. 4, Troy, NY, 12180, United States of America liux12@rpi.edu, Satish Ukkusuri

We present a methodology to obtain time-dependent OD matrices, which is a required input for dynamic traffic simulation, using partial static and partial dynamic link flows information. The main focus is on the practical guidelines to obtain time depdent OD matrices using existing data.The approach is applied to the Manhattan, NY network to demonstrate the challenges and we provide recommendations for future applications.

■ MC20

C-Room 28E, Upper Level

Dynamic Programming

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Stephan Meisel, University of Braunschweig, Muehlenpfordtstr. 23, Braunschweig, Germany, Stephan.Meisel@tu-bs.de

1 - Approximate Dynamic Programming for Routing a Service Vehicle with Stochastic Customer Requests

Stephan Meisel, University of Braunschweig, Muehlenpfordtstr. 23, Braunschweig, Germany, Stephan.Meisel@tu-bs.de, Dirk Mattfeld

We present an Approximate Dynamic Programming approach to a dynamic vehicle routing problem with one vehicle and stochastic customer requests. Early requesting customers definitely request for service. Late request customers appear randomly over time. The goal is serving the maximum number of requesting customers within a fixed period of time. The performance of our approach is compared to the performance of a number of state-of-the-art waiting strategies and a greedy heuristic.

2 - A Bi-directional Resource-bounded Dynamic Programming Approach for the TSP with Time Windows

Jing-Quan Li, California PATH, University of California, Berkeley, Richmond, CA, 94804, United States of America, jingquan@path.berkeley.edu

This paper presents a bi-directional resource-bounded label correcting algorithm for the traveling salesman problem with time windows, in which the objective is to minimize travel times. Label extensions and dominance start simultaneously in both forward and backward directions. Our algorithm generates optimal solutions for a number of the instances with wide time windows for which no optimal solutions have been previously reported.

3 - The Traveling Purchaser Problem With Stochastic Prices

Seungmo Kang, University of Illinois at Urbana-Champaign, Room 1115, 1206 West Gregory Drive, MC-195, Urbana, IL, 61801, United States of America, skang2@illinois.edu, Yanfeng Ouyang

This research formulates an extension of the traveling purchaser problem where multiple types of commodities are sold at spatially distributed locations with stochastic prices. A purchaser's goal is to find the optimal routing and purchasing strategies that minimize the expected total travel and purchasing costs. We propose an exact solution algorithm, an iterative approximate algorithm and a greedy heuristic.

4 - Real-time Matching of Supply and Demand for Sustainable Passenger Transportation

Niels Agatz, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, nagatz6@isye.gatech.edu, Xing Wang, Alan Erera, Martin Savelsbergh

While ride-sharing is not new, the ubiquity of GPS-enabled cell phones has enabled practical dynamic ride-sharing. To exploit hardware capabilities, ride-sharing systems are needed to match up people for rides in ways that achieve both user and system objectives. In this research we develop a set of alternative control algorithms for such systems and study the characteristics of environments within which dynamic ride-sharing offers the greatest potential for emission and congestion reduction.

■ MC21

C-Room 30B, Upper Level

Advances in Network Flow Models II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Weihao Yin, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, alexyin@vt.edu

1 - A Graph Theoretic Formulation for Large Scale Single Destination Dynamic Traffic Assignment
Georgios Kalafatas, Purdue University, United States of America, gkalafat@purdue.edu, Srinivas Peeta

Recently, the authors presented a graph theoretic formulation for the single destination dynamic traffic assignment (SD-DTA) problem based on the CTM. In this study, we further improve its performance by moving from the cell level to the link level consistent with traffic flow theory. Computational experience from the Borman Expressway network in northern Indiana is presented.

2 - A Network Flow Algorithm for the Cell Based Single Destination Dynamic Traffic Assignment Problem
Hong Zheng, Ph.D., The University of Arizona, 1209 E 2nd St, Rm 206, Tucson, AZ, 85721, United States of America, hzheng@email.arizona.edu, Yi-Chang Chiu

We give a network flow algorithm for the cell based single destination system optimal dynamic traffic assignment problem.We show it equals the earliest arrival flow (EAF) then solve EAF on the time-expaned network. It is able to solve the case where backward wave speed is lower than the forward wave speed. The solution creates the same wave propagation effect with the cell transmission model, and avoids holding vehicles on the ordinary/merge connectors. Numerical examples show it outperforms LP.

3 - CTM-based Mathematical Program of the Dynamic Traffic Assignment under Incident Conditions
Weihao Yin, Virginia Tech, 7054 Haycock Road, Falls Church, VA, 22043, United States of America, alexyin@vt.edu, Pam Murray-Tuite

This study develops a mathematical program model for DTA that encapsulates the Cell Transmission Model by constructing a time-expanded network. Allowing multi-destination flows, this work focuses on modeling network traffic evolution under incident conditions while complying with user equilibrium and retaining computational tractability.

■ MC22

C-Room 30C, Upper Level

Panel Discussion: The Industry Job Search

Cluster: Job Placement Service
Invited Session

Chair: Talisa Murray, systems analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu

1 - Industry Job Search
Moderator: Talisa Murray, systems analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu, Panelists: Anne Robinson, Stephen Strauss, Grace Lin, Krishna Jha

The panel will lead an informal discussion concerning the industry interview process, the appropriate steps to take during the job search, and the challenges that may be faced along the way. Time will be provided for questions and answers.

■ MC23

C-Room 30D, Upper Level

Joint Session MAS/SIM: DIME/PMESII Pt 4

Sponsor: Military Applications Society & Simulation
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - PMESII - LOE Metric Ontology for IW Analysis
Paul Works, TRADOC Analysis Center, 225 Sedgwick Avenue, Fort Leavenworth, KS, 66027, United States of America paul.works@us.army.mil, Stephen Black, Sarah Holden

This briefing outlines the TRAC-led development of a robust Irregular Warfare (IW) Analytic Capability. It specifically addresses the development of a PMESII - Line of Effort (LOE) Metric Ontology; how that Ontology will be used as a foundational product for analyzing how military and whole-of-government operations impact populations, and how such impacts can be measured and understood.

2 - Understanding Information Operations in Context of Irregular Warfare Using DIME/PmESII Simulation
Alok Chaturvedi, CEO, Simulex Inc., 3482 McClure Ave, Ste 120, West Lafayette, IN, 47906, United States of America, alok@simulexinc.com

We present several simulation experiments to assess how Information Operations shape population attitudes in four provinces of Afghanistan, Helmand, Ghazni, Herat, and Kabul. We represent the PmESII systems of Afghanistan in SEAS-VIS by five primitive constructs: Individuals, Organizations, Institutions, and Infrastructure. Within this environment we study Information Operations and the dynamic interplay between the environment, citizens, leaders, media, organizations and institutions.

3 - The National Operational Modeling Environment (NOEM)
John Salerno, Principle Computer Engineer, AFRL, 525 Brooks Rd, Rome, NY, 13441, United States of America, John.Salerno@rl.af.mil

NOEM is a stochastic system dynamics model representing a nation-state via a collection of interconnected regions. The NOEM allows users to forecast potential problem regions, test a wide variety of policy options, suggest suitable courses of actions given a set of initial conditions, and determine resource allocation methods that best improve overall national or regional stability. This presentation will provide an overview of NOEM, its current functionality and planned enhancements.

■ MC24

C-Room 30E, Upper Level

Manpower Modeling II

Sponsor: Military Applications Society
Sponsored Session

Chair: Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington, VA, 22207, United States of America, marie.hall@us.army.mil

1 - What is a Quality Soldier? A Multi-Attribute Model of Soldier Performance and Recruit Potential
Robert Dees, Major, US Army, Instructor/ORCEN Analyst, United States Military Academy, Department of Systems Engineering, Department of Systems Engineering, Mahan Hall, Room 306, West Point, NY, 10996, United States of America, Robert.Dees@usma.edu

The first paragraph of FM 1, The Army, states, "Only with quality Soldiers answering the noble call to serve freedom can the Army ensure the victories required..." All would agree that we want "Quality Soldiers," but what is one? We offer a model of "Soldier Performance" and statistical insights into "Recruit Potential" based on consultation in operational units. The intent is to measure what we want so that we can make better decisions related to the "Quality Soldier" in the future.

2 - Searching for Balance - Projecting Unit and Individual Time Between Deployments
Matt Dabkowski, Analyst/Instructor, Department of Systems Engineering, United States Military Academy, US Army, Fourth Floor, BLDG 752, Mahan Hall, West Point, ny, 10996, United States of America, matthew.dabkowski@usma.edu, Mark Zais

We develop a discrete event simulation that faithfully replicates the careers of the Army's infantrymen between 2014 and 2024. In particular, drawing on myriad data sources, regulations, and policies, we empirically answer the question, "Given 45 active BCTs, a 547.4K end strength, a sustained 16-BCT commitment in the GWOT, and ARFORGEN-Focused Manning, can the Army achieve a 1:2 deploy to dwell ratio for its active duty Soldiers?"

3 - Army Officer Force Profiles and Markovian Manpower Models
Andrew Hall, Assistant Professor, United States Military Academy, Department of Mathematical Sciences, 4760 N 40th Street, Arlington, VA, 22207, United States of America, andrew.o.hall@us.army.mil, Michael Fu

We model the Army officer manpower system as a mathematical program. The mathematical program is designed to minimize the absolute deviation from the Army's Personnel Manning and Authorization Document and to place smoothing controls on the spectrum of manpower decisions and controls. We explore the attainability and sustainability of Army force profiles. We propose a new network structure that incorporates both rank and years in grade to combine cohort, rank, and specialty modeling.

4 - The Army's Reliance on Stop Loss
Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington, VA, 22207, United States of America, marie.hall@us.army.mil, Andrew Hall

Stop Loss is an Army policy which requires Soldiers to remain in the Army beyond their contractual obligation in order to complete a unit's deployment to Iraq or Afghanistan. Stop loss was implemented to maintain unit cohesion and stabilize the force. We address projecting the quantity of soldiers in Stop Loss in the future, and analyzing strategies to eliminate the use of Stop Loss and the associated risks and costs that need to be mitigated when eliminated.

■ MC25

C-Room 31A, Upper Level

Improvements in Aviation Application

Sponsor: Aviation Applications
Sponsored Session

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

1 - Major Determinants of Aviation Environmental Impacts and Key Sensitivities
Terence Thompson, Metron Aviation, Dulles, VA, United States of America, terry@metronaviation.com

We discuss the major determinants of aviation impacts on the environment in terms of noise, air quality, and climate. We explore key sensitivities of these impacts to such factors as the level of flight activity, the distribution of flight demand, the composition of the fleet servicing the demand, and various types of environmental performance measures for aircraft in the fleet. The relative benefits of major policy options are also explored.

2 - Estimation of Taxi-out Time Using Approximate Dynamic Programming
Poornima Balakrishna, Ph.D. Candidate, George Mason University, 4400 University Drive, MSN 4A6, Fairfax, VA, 22030, United States of America, pbalakri@gmu.edu, Rajesh Ganesan, Lance Sherry

The primary objective of this research is to accurately predict taxi-out time of flights at major airports at least fifteen minutes before scheduled gate departure. This research presents a novel reinforcement learning based stochastic approximation scheme for predicting taxi-out times. The prediction problem is cast in a probabilistic framework of stochastic dynamic programming and solved using approximate dynamic programming approaches.

3 - Markov-based Models of Airline Customersí Online Search and Purchase Behaviors
Misuk Lee, PhD Student, Georgia Institute of Technology, mlee@gatech.edu, David Post, Laurie Garrow

This study analyzes how individuals search for information about air ticket attributes and prices using data from a website that sells tickets at low prices to travelers with a high degree of travel flexibility. Markov-based models are used to capture the dynamics of customers' searching and purchasing behaviors. Empirical results reveal that what visitors saw in previous site visits clearly influences future revisit and purchase probabilities, as well as search intensity within sessions.

■ MC26

C-Room 31B, Upper Level

Airport Operations and Competition

Sponsor: Aviation Applications
Sponsored Session

Chair: Scott Widener, University of Miami, 268 McArthur Engineering Building, University of Miami, Coral Gables, FL, 33124, United States of America, s.widener@umiami.edu

1 - Measuring Airport Efficiency With Fixed Asset Utilization
Scott Widener, University of Miami, 268 McArthur Engineering Building, University of Miami, Coral Gables, FL, 33124, United States of America, s.widener@umiami.edu, Murat Erkoc

Existing airport efficiency models are predicated upon analysis of each airport as a collection of assets, but do not take into account the utilization of these assets. This research focuses on a DEA model to look at how the assets are actually used by airports, both individually and collectively, to determine ways to improve the system with both operational improvements and capital investment by addressing the effects of both the on-time and delayed arrivals and departures.

2 - Parallel Aviation Agreements: Who Are They Good For?
Nicole Adler, Hebrew University of Jerusalem, Mount Scopus, Jerusalem, Israel, msnic@huji.ac.il, Eran Hanany

The simultaneous impact of frequency and price on consumer and producer surplus across hub-to-hub agreements has yet to be analyzed. Using a hybrid competitive-cooperative game theoretic framework, we compare competitive markets, bilateral agreements, codeshares and anti-trust immune alliances. The results suggest that competition does not always maximize social welfare on parallel links, contrary to current thinking, hence we present a model that allows governments to analyze specific markets.

3 - A Study on the Impact of Competition on Airport Congestion
Lavanya Marla, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge MA, United States of America lavanya@MIT.EDU, Niklaus Eggenberg, Cynthia Barnhart

Air transportation in the US is increasingly faced with the problem of airport congestion: airlines tend to over-schedule to attract market share and revenue. Unfortunately, the airlines share a limited resource - airport capacity. The underlying question we answer is whether competition can force the airlines to voluntarily adapt their schedules, due to high delay costs, thus reducing congestion, or if competition-regulatory measures by a central authority are required.

4 - Analysis of New York LaGuardia Airport Gate-Waiting Delays
Jianfeng Wang, George Mason University, 4450 Rivanna Ln # 3727, Fairfax, VA, 22030-4441, United States of America, jwang5@gmu.edu, John Shortle

Airport gates are one of the congestion points of the air transportation system. When an arriving flight lands on a runway, it is possible that it cannot pull into its gate due to gate unavailability. We define this phenomenon as gate-waiting delay. This paper gives a functional analysis of gate-waiting delays at New York LaGuardia airport.

■ MC27

C-Room 31C, Upper Level

Simulation in Health Care I

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Eva Enns, PhD Student, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu

1 - Understanding the Role of Family Doctors Using System Dynamics Simulationn
Evrim Didem Gunes, Koc University, Sariyer, Istanbul, Turkey, egunes@ku.edu.tr, Mehmet Cagri Dedeoglu

This work is motivated by the introduction of family practice in Turkey. The objective is to understand the expected changes in the behavior of patients and providers with this new system. System dynamics methodology is used to model patient flows, and to analyze the effect of introducing a gatekeeping system on the workloads for hospitals and for family doctors. Dynamics of service quality, word-of-mouth, referral rates, number of available family doctors are investigated with scenarios.

2 - Cost Effectiveness of the Vancouver Supervised Injection Facility
Greg Zaric, Associate Professor, Ivey School of Business, 1151 Richmond St N, London, ON, N6A3K7, Canada, gzaric@ivey.uwo.ca, Ahmed Bayoumi

Insite, a supervised injection facility, has operated in Vancouver, Canada, since 2003. We developed an epidemic model with 12 compartments representing all combinations of 4 infection categories and 3 behavior categories. We simulated for 10 years to estimate the incremental costs and health impact of the facility. The facility was either cost saving or had an incremental cost effectiveness ratio of less than $50,000 per life year gained under a wide range of scenarios.

3 - An Epidemic Model of HIV Treatment under Resource Constraints
Robert Koppenhaver, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, rzk9@pitt.edu, Andrew Schaefer, Mark S. Roberts

Antiretrovirals are the only treatment for HIV. In areas where HIV is prevalent, they remain a scarce resource. We consider a population of HIV+ patients in need of fixed number of antiretrovirals. We allow new patients to enter the population to account for the effects of epidemic growth. We evaluate the World Health Organization's treatment recommendations. We also model the problem as a dynamic program and evaluate the performance of treatment policies obtained from this model.

4 - Simulating the Spread of HIV through a Dynamic Sexual Partnership Network

Eva Enns, PhD Student, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu, Margaret Brandeau, Eran Bendavid, Thomas Igeme

We describe a microsimulation model of the spread of infectious disease over a dynamic contact network. Our model can be used to study the effect of network structure and dynamics on the spread of disease. To illustrate, we present a model of the spread of HIV over a dynamic sexual partnership network representative of the demographics and sexual behavior of Southern Africa. In particular, we use our model to study the impact of concurrent sexual partnerships on the HIV epidemic in this region.

■ MC28

H-Room 500, Fifth Floor

Web-driven RM Applications

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Assaf Zeevi, Professor, Columbia University, Graduate School of Business, Uris Hall, Room 406, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

1 - Revenue Maximization in Reservation-Based Online Advertising

ana radovanovic, Research Scientist, Google Inc, 76 Ninth Ave., New York, United States of America, anaradovanovic@google.com, Assaf Zeevi

In this talk we will describe a stylized model of the sales process in the reservation-based online advertising industry which is used for selling the premium ads. We formulate it as a constrained stochastic control problem with the objective of maximizing the long run revenue rate. The exact solution of this problem, is intractable and, instead, we propose a certain relaxation of this model which leads us to ways to design asymptotically optimal dynamic control policies.

2 - Optimal Auctions with Risk Averse Sellers

Mukund Sundararajan, Stanford University, 353 Serra Mall, Stanford, United States of America, mukous@gmail.com

Standard optimal (revenue maximizing) auction theory assumes that sellers are risk neutral. We begin to develop a parallel theory for risk-averse sellers.

3 - Optimal Dynamic Behavioral Targeting in on-line Advertising

Denis Saure, Columbia University, 3022 Broadway, Uris Hall, 4N, New York, NY, 10025, United States of America, dsaure05@gsb.columbia.edu, Assaf Zeevi

We study the problem of a publisher who selects ads to display to customers based on their profiles. By offering different ad bundles and observing ad-clicks, the publisher learns about consumer preferences. This experimentation, while incurring an immediate potential loss in revenues, should improve downstream ad customization and overall profits. We develop dynamic policies that balance these exploration-exploitation trade-offs and prove that their performance is best possible.

4 - Uncertainties in Allocation and Pricing in Ad Auctions

Hamid Nazerzadeh, Post-doc Researcher, Microsoft Research, One Memorial Dr, Cambridge, MA, United States of America, hamidnz@microsoft.com

Internet advertising is a market in which online service providers, such as search engines, sell the space on their webpages to advertisers. There are uncertainties about the quantity and quality of these advertisement opportunities. In this talk, I discuss some of the challenges caused by these uncertainties.

■ MC29

H-Room 501, Fifth Floor

Climate Change, Technology, and Policy

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

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

1 - Climate Change Energy Technology R&D Portfolio Analysis

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

We perform a portfolio analysis to get insights about the socially optimal R&D portfolio, and how it changes with increasing risk in climate damages. We implement data collected from expert elicitations on how government funding impacts the probability of success in three key climate change energy technologies — solar photovoltaics (PV), nuclear power, and carbon capture and storage (CCS). We use a Mixed Integer Non-linear Stochastic Program and do sensitivity over damage uncertainty.

2 - Solar Mapping and Economic and Emissions Benefits

Yihsu Chen, University of California, Merced, 5200 N. Lake Rd, Merced, CA, 95343, United States of America, yihsu.chen@ucmerced.edu, Qinghua Guo, Carlos Coimbra

One advantage of solar systems is their modularity that allows for distributed scale applications close to the load centers and for reduced costs of transmission compared to other renewable energy. We develop near real-time Global Horizontal Irradiance (GHI) and Direct Normal Irradiance (DNI) data for the California by blending satellite and ground-based measurements. We present preliminary results on potential fuel costs saving and emissions benefits based on empirical and modeling approaches.

3 - Stochastic Modeling of Endogenous Technological Change

Ekundayo Shittu, Tulane University, 7 McAlister Drive, New Orleans, LA, 70118, United States of America eshittu@tulane.edu, Volker Krey

We address an aspect of technological innovation, learning-by-doing, by exploring how uncertainties in learning rates impact social R&D investments into a range of energy technologies. We add stochastic learning to an existing model at IIASA through a cost-constrained risk-minimizing optimization model of the energy system. With uncertain learning, a prudent intermediate path of energy technology penetration is charted, and a more diversified technological portfolio is revealed.

■ MC30

H-Room 502, Fifth Floor

Forestry V: Wood-for-Energy Production Systems

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

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Feasibility and Climate Change Mitigation Potential of Large Scale Wood Bioenergy Production Systems

Catalin Ristea, Department of Forest Resources Management, University of British Columbia, Vancouver, BC, Canada, catalin.ristea@ubc.ca, Thomas Maness

This study is concerned with the economic feasibility of large scale wood-for-energy production systems and their effectiveness as environmentally sustainable climate mitigation strategies. Within a life cycle framework (that integrates a forest level model with biomass-to-bioenergy processing simulation modules) we estimate cost-benefit trade-offs and evaluate opportunities to reduce negative environmental impacts and achieve economic efficiencies.

2 - Feasibility of Managing Crown Fire Potential in California and Oregon via Targeted Thinning

Jeremy Fried, U.S. Forest Service, Pacific Northwest Research Station, Portland, OR, United States of America, jeremy.fried@fs.fed.us

The BioSum fuel treatment modeling system was applied to several thousand forest inventory plots representing a 21 million acre forested landscape following 23 policy scenarios covering diverse combinations of objectives, effectiveness expectations, and size-based constraints on tree removal. Product yield, area treated, bioenergy capacity and net revenue were all highly contingent on these and other scenario assumptions, such as whether revenues from product sales must cover treatment costs.

3 - Optimizing Monitoring of Ecological Indicators to Detect Climate Impacts in Boreal Forests

Tara Barrett, U.S. Forest Service, Pacific Northwest Research Station, Anchorage, AK, United States of America, tbarrett@fs.fed.us, Hans Andersen, Ken Winterberger

Optimization was useful for designing a monitoring system that could provide efficient estimates for five key ecological indicators: (1) total above-ground carbon in tree biomass; (2) presence of invasive vascular plants; (3) hardwood forest area; (4) mean stand age; and (5) basal area gross growth of Picea glauca. The method was applied to a 13.7 million hectare region of Alaska, with decision choices representing various combinations of field and remote sensing (lidar) plots.

■ MC31

H-Room 503, Fifth Floor

Competition in the Supply Chain

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Elodie Adida, University of Illinois at Chicago, 842 W. Taylor St., Chicago, United States of America, elodie@uic.edu

1 - Loss of Welfare in Oligopolistic Games: Application to Deregulated Electricity Markets

Georgia Perakis, Professor, Sloan School, MIT, 50 Memorial Drive Building E53-389, Cambridge, MA, United States of America, georgiap@MIT.EDU, Jonathan Kluberg

We study the performance of free competition in a market where some suppliers have a dominant position. We want to understand how much of society's welfare can be lost in deregulating a market that doesn't have a perfectly competitive structure (a large number of small suppliers). We apply our results to the analysis of electricity markets. We derive loss of welfare bounds for some of the traditional models of electricity supply competition, account for grid constraints.

2 - Competing for Shelf Space

Guillaume Roels, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States of America, guillaume.roels@anderson.ucla.edu, Victor Martinez de Albeniz

In this talk, we study the dynamics arising from the competition for shelf space. We consider a retailer that seeks to allocate its shelf space among different products to maximize its profit. To obtain larger shelf space allocations, product manufacturers can offer lower wholesale prices, thereby increasing the retailer's profit margin on their products. We characterize the competitive equilibrium arising from the scarcity of space and quantify the loss of efficiency.

3 - Channel Management in a Chain of Oligopolies

Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. Geroge Street, Toronto, ON, M5S3E6, Canada, ming.hu@rotman.utoronto.ca

We explore channel management of competitive suppliers selling through the same pool of competing retailers. In the existence of fierce competition due to high substitutability among suppliers' products or retailers' stores, vertical coordination through contracts by a supplier may fail to be a dominant strategy in a Stackelberg game where suppliers act as leaders to set wholesale prices and retailers act as followers to set retail prices.

4 - Efficiency and Coordination in a Supply Chain with Competing Manufacturers and Retailers

Elodie Adida, University of Illinois at Chicago, 842 W. Taylor St., Chicago, United States of America, elodie@uic.edu, Victor DeMiguel

We study competition in a supply chain where multiple manufacturers compete to supply a set of products to multiple risk-averse retailers who compete to satisfy the uncertain consumer demand. For the symmetric supply chain, we give closed-form expressions for the unique equilibrium. We also study (numerically) the asymmetric supply chain and its efficiency. Finally, we show how revenue-sharing contracts can be used to coordinate the decentralized symmetric chain.

■ MC32

H-Room 504, Fifth Level

Financial Engineering: Models and Statistical Analysis

Cluster: Financial Engineering
Invited Session

Chair: Steven KouProfessor, Columbia University, 312 Mudd, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States of America, sk75@columbia.edu

1 - A Model of Optimal Selling with Liquidity Constraint and Transaction Cost

Xin Guo, Associate professor, UC at Berkeley, Berkeley, United States of America, xinguo@newton.berkeley.edu, Mihail Zervos

In this talk, we present a model of selling stocks for big investors where aggressive selling will have negative price impact and conservative action will accumulate large transaction cost. We provide explicit solutions for the optimal selling strategy. Based on joint work with Mihail Zervos of London School of Economics.

2 - A Model for Electricity Spot and Futures Prices

Ning Cai, Assistant Professor, Department of IELM, HKUST, Hong Kong, China, ningcai@ust.hk, John Birge, Steven Kou

We propose a model for the on-peak electricity spot and futures price. More precisely, we model the logarithm of the scaled peak demand using two independent mean reverting affine (jump) diffusion processes, which describe different mean reversion structures of normal peak demands and spikes of demands separately, and then derive a model for the on-peak spot price based on the minimum Nash equilibrium for the demand-and-price function. Several advantages relating to our model are discussed.

3 - What is the True Cost of Active Management? A Comparison of Hedge Funds and Mutual Funds

Jussi Keppo, University of Michigan, 1205 Beal Avenue, Ann Arbor, United States of America, keppo@umich.edu, Antti Petajisto

On the surface, hedge funds seem to have higher fees than actively managed mutual funds. However, a mutual fund combines active positions with a passive position in the benchmark index, which can make the active positions expensive. A hedge fund takes both long and short positions and uses leverage, which makes the active positions cheaper, but this can be offset by the expected incentive fees. We investigate the tradeoffs between a mutual fund and a hedge fund for a range of parameter values.

4 - What Is a Good External Risk Measure

Xianhua Peng, Department of Mathematics and Statistics, York University in Toronto, 16 Aldwinckle Heights, Toronto, ON, M3J 3S6, Canada, xp2102@columbia.edu, Steven Kou

We point out that risk measures used for external regulation should have robustness with respect to modeling assumptions and data. We propose new data-based risk measures called natural risk statistics that are characterized by a new set of axioms based on the comonotonicity from decision theory. Natural risk statistics include VaR with scenario analysis as a special case and therefore provide a theoretical basis for using VaR along with scenario analysis as a robust external risk measure.

■ MC33

H-Room 505, Fifth Floor

Economic Models for Procurement Contract Design

Cluster: Economic Models in Operations Management
Invited Session

Chair: Sammi Tang, Assistant Professor, University of Miami, 5250 University Drive, Coral Gables, FL, 33146, United States of America, ytang@miami.edu

Co-Chair: Diwakar Gupta, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu

1 - Impact of Product Recall on Supplier Selection and Product Deployment

Max Shen, Professor, University of California-Berkeley, Dept of IEOR, Berkeley, CA, 94704, United States of America, shen@ieor.berkeley.edu, Ying Rong

Product recalls always cause big problems to firm's operations. The firm needs to not only deal with the logistics related to recalled products but also cope with damaged reputation. Therefore, the recalls affect both short-term and long-term profitability of the firm. In this talk, we provide a proactive strategy of integrating supplier selection and product deployment to reduce overall impact brought by product recalls.

2 - Flexible Contracts for Retail Supply Chains

Hao-Wei Chen, University of Minnesota, 111 Church Street S.E., Minneapolis, MN, 55455, United States of America, hwchen@ie.umn.edu, Diwakar Gupta, Haresh Gurnani

Retailers and suppliers need flexible supply contracts to reduce lost sales during stock out periods. However, too much flexibility can lower suppliers' profits. Moreover, consumers' response can affect each party's profits and the supply-chain fill rate. We compare three contracts when the retailer offers to fast-ship out-of-stock items to customers and characterize the relative benefit of various levels of contract flexibility on supply-chain performance.

3 - Buyer Preferences for Inventory Ownership and Placement in Developing the Negotiations Plan

M. Johnny Rungtusanatham, Carlson School of Management, University of Minnesota, Minneapolis, MN, 55455, United States of America, rung0002@umn.edu, Cynthia Wallin, Elliot Rabinovich, Yuhchang Hwang

We test hypotheses about buyer preferences for ownership and placement of inventory for an externally-sourced critical item. These preferences are typically articulated in the negotiations plan. The hypotheses tested relate specific transaction attributes to inventory ownership and placement preferences within

a buyer-supplier dyad. Data for the empirical test were collected from purchasing professionals in a role-playing experiment and analyzed using multinomial logistic regression.

4 - First Mover Advantage with an Intermediary and Information Asymmetry

Milind Sohoni, Indian School of Business, India, milind_sohoni@isb.edu, Jiri Chod, Sridhar Seshadri, Aditya Jain

We consider two firms, endowed with private and imperfect demand information, that sequentially decide their sale quantity and place orders with a common manufacturer. We study different information disclosure scenarios and address the question when it pays to be the first(second) mover. We analyze the factors that drive such benefit.

5 - Optimal Sourcing and Subsidy Policy When Suppliers Have Random Yield Loss

Sammi Tang, Assistant Professor, University of Miami, 5250 University Drive, Coral Gables, FL, 33146, United States of America, ytang@miami.edu, Haresh Gurnani, Diwakar Gupta

We consider a buyer whose suppliers are prone to random yield loss. The suppliers may improve yield by making a costly investment. The buyer, in turn, could submit a traditional order, provide a subsidy to cover a portion of the investment cost along with its order, or diversify by ordering from multiple uncorrelated suppliers. We characterize buyers' and suppliers' decisions and show how supply uncertainty affects investment and diversification strategies.

■ MC34

H-Room 520, Fifth Floor

Emergency Response/Humanitarian Logistics

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

Chair: Ali Ekici, PhD Student, Georgia Institue of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, aekici@isye.gatech.edu

1 - Interactions of Infrastructure and Equitability in African Health Care Delivery

Jacqueline Griffin, Georgia Institute of Technology, Ferst. Dr., Atlanta, GA, United States of America, jgriffin3@gatech.edu, Martin Savelsbergh, Paul Griffin

Due to limited economic resources, sparsely located villages, and poor infrastructure the task of equitably distributing health care in Sub-Saharan Africa can be challenging. While incorporating the interactions between resource constraints, infrastructure, and settlement patterns, we examine the tradeoff between economic efficiency, health outcome, and equitability. Additionally we study the impact of investment in infrastructure on health care delivery and the efficient use of limited budgets.

2 - Three Central Stockpiles for 32 Million Beneficiaries: UNHCR's Inventory Challenge

Jessica McCoy, PhD Student, Stanford University, 377 Terman Engineering Center, Stanford, CA, 94305, United States of America, jhmccoy@stanford.edu, Margaret Brandeau

The United Nations High Commissioner for Refugees provides shelter and basic subsistence items to refugees and establishes and maintains refugee camps. UNHCR seeks to improve the timeliness and quality of disaster response. We develop a model to gain insights into appropriate shipment strategies and stockpile size for such operations.

3 - Routing and Scheduling for Medication Distribution Planning

Jeffrey Herrmann, University of Maryland, Department of Mechanical Engineering, 2181 Martin Hall, College Park, MD, 20742, United States of America, jwh2@umd.edu

In a public health emergency, officials must plan the logistics for distributing medication to points of dispensing (PODs). Our approach for solving the medication distribution problem separates the problem into two subproblems: (1) the routing problem assigns PODs to vehicles and creates routes for each vehicle, and (2) the scheduling problem determines when the vehicles should start these routes and how much material should be delivered on each trip.

4 - Real-time Applicability of Pandemic Modeling Approaches

Diana Prieto, University of South Florida, 4202 E. Fowler Ave, Tampa, Fl, 33620, United States of America, dprieto@mail.usf.edu, Alex Savachkin, Andres Uribe, Tapas Das

We present a systematic review of the existing research literature on pandemic influenza models for containment and mitigation. We examine how the approaches address: spatio-temporal structure and contact process, disease transmission, natural history, and intervention strategies. We also assess real-time applicability of the existing models as their capability to readily use demographic, social-behavioral, and epidemiological surveillance data, to generate dynamic mitigation strategies.

■ MC35

H-Sapphire A, Fourth Floor

Healthcare Operation Management

Sponsor: Health Applications
Sponsored Session

Chair: Shinyi Wu, Assistant Professor, Department of Industrial and Systems Engineering, University of Southern California, 3715, McClintock Ave, GER 240, Los Angeles, CA, 90007, United States of America, shinyi@rand.org

1 - Identifying Operational Challenges in Safety-net Operating Rooms

Sarah Kianfar, PhD Student, ISE Department, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, sarah.kianfar@gmail.com, Pai Liu, Yihan Xie, Shinyi Wu

Improving operating room (OR) services is imperative to ensure fiscal viability of and access to safety net hospitals. To identify prevailing concerns regarding OR efficiency, we used a unique dataset of proposals from 20 public hospitals applying for operational consultation. The concerns were coded using exploratory taxonomy guided by a literature review. Scheduling add-on cases, low compliance with scheduled time, and lack of operational standards are the most frequently mentioned problems.

2 - Improving Surgery Scheduling: Insights From Multi-site Management Engineering Consultations

David Belson, Adjunct Professor, ISE Department, University of Southern California, 3715, McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, belson@usc.edu, Shinyi Wu

We have studied surgery patient flow in 12 hospitals and found significant ways to increase utilization and benefit from scheduling. The software should include optimization and decision assistance that has an integer programming model identify improvements and a simulation validate. Actions are necessary to implement recommendations. Double booking and changing hours of operation can provide significant benefits. We recommend certain guidelines and tracking measures to assure productivity.

3 - An Implementation Framework Integrating Lean and Computer Simulation for Healthcare Improvement

Pai Liu, Graduate Research Assistant, ISE Department, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, pailiu@usc.edu, Shinyi Wu

Lean and computer simulation are two process improvement approaches increasingly used in health care system; each has their own advantages and limitations. We propose a synchronous implementation framework by integrating these two methods to reduce barriers for healthcare quality and process improvement projects.

4 - Workflow Study of an Electronic Referral System

Yihan Xie, Graduate Research Assistant, ISE Department, University of Southern California, 3715 McClintock Ave., GER 240, Los Angeles, CA, 90089, United States of America, yihanxie@usc.edu, Shinyi Wu

Access to specialty care has become an increasingly pressing issue for safety net settings. An e-referral system is developed to improve referring process to better utilize scarce specialist appointments. To assess its impact on the workflow of involved providers and on patient outcomes, we built a simulation model with data from an e-referral testing site. The simulation allows us to compare between traditional and e-referral systems and to identify strategies to improving the system.

■ MC36

H-Sapphire B, Fourth Floor

2009 Pierskalla Competition Papers II

Sponsor: Health Applications
Sponsored Session

Chair: Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - An Analysis of Pediatric Vaccine Formulary Selection Problems
Shane Hall, Assistant Professor of Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, shane.hall@afit.edu, Sheldon Jacobson, Edward Sewell

This presentation describes the General Vaccine Formulary Selection Problem for obtaining an optimal childhood immunization vaccine formulary with respect to economic costs and extraimmunization. Solution methods and computational results are presented and the trade-offs between alternative objectives are also discussed. This research allows public health policy makers and pediatricians to evaluate the combinatorial explosion of choices spawned by the development of combination vaccines.

2 - Adaptive Appointment Systems
Wen-Ya Wang, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, wenya@ie.umn.edu, Diwakar Gupta

We develop a framework for the design of the next generation of appointment systems that dynamically learn and update patient preferences and use this information to continuously improve appointment-booking decisions. We show that by using an adaptive approach, primary-care clinics can achieve a more robust performance in terms of their revenue and the goal of meeting patients' preferences for physician and time of day.

3 - Appointment Scheduling with Discrete Random Durations
Mehmet Begen, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, mbegen@ivey.uwo.ca, Maurice Queyranne

We determine optimal appointment schedule for a given sequence medical procedures/exams on a single processor (e.g., operating room, examination facility), to minimize the expected total underage and overage costs when each job has a random processing duration given by a joint discrete probability distribution. Our model can handle a given due date for the total processing (e.g., end of day for an operating room) after which overtime is incurred and, no-shows and some emergencies.

4 - When to Treat Prostate Cancer Patients Based on their PSA Dynamics
Mariel Lavieri, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Mariel.Lavieri@sauder.ubc.ca, William J. Morris, Scott Tyldesley, Martin Puterman

We model the decision of when to start radiation therapy in prostate cancer patients undergoing hormone therapy. Initial beliefs are based on population characteristics clustered by patient type. Using a dynamic Kalman filter model, patient specific estimates are updated as new information becomes available. Based on a cohort of intermediate risk patients, we show that our approach outperforms the current protocol by identifying earlier when radiation therapy should start in each patient.

■ MC37

H-Sapphire C, Fourth Floor

Supply Chain Coordination

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Doug Thomas, Penn State, 463 Business Building, University Park, PA, 16802, United States of America, dthomas@psu.edu

1 - Perishable Item Inventory Management and its Impact on the Bullwhip Effect
Sandra Transchel, Smeal College of Business, 461 Business Building, University Park, PA, 16802, United States of America, sxt37@psu.edu, Stefan Minner

An important element to operating a smooth flowing supply chain is to mitigate and preferably eliminate the Bullwhip Effect. Significant research has been done to understand causal factors that create supply chain oscillations for durable products. We analyze three replenishment policies for products with a limited shelf-life and its impact on the Bullwhip effect. Our particular focus is on lead time sensitivity, issuing policy (FIFO and LIFO), and lost sales and backorder assumption.

2 - On Dis-coordinating Contracts for Competing Supply Chains
Tong Wang, Assistant Professor, National University of Singapore, 1 Business Link, #03-31, Singapore, 117592, Singapore, tong.wang@nus.edu.sg

Two supply chains are competing in quantity in a market with uncertainty. Each supply chain consists of one manufacturer and one retailer. We study how the manufacturers should design the contracts to their downstream retailers to maximize their own profits. Specifically, we show that contracts coordinating the supply chains are not necessarily the optimal choice and that a dis-coordinated supply chain may gain competetive advantages against a coordinated one.

3 - The Transshipment Problem with Partial Lost Sales
Yale Herer, Technion - Israel Institute of Technology, Faculty of Industrial Engineering and Management, Haifa, 320000, Israel yale@technion.ac.il, Ella Dahan

We consider two cost-identical retailers which cooperate in a single period through transshipments in order to maximize joint profits. We consider the possibility that customers are not always willing to wait for transshipments; there exists a probability that a customer will return at the end of the period. Thus the number of returning customers is not known until after the transshipment decisions are made. The form of the optimal transshipment and replenishment policies is investigated.

■ MC38

H-Sapphire D, Fourth Floor

Supply Chain and Inventory Models

Cluster: Inventory Management
Invited Session

Chair: Alp Muharremoglu, Columbia University, Graduate School of Business, New York, United States of America, alp2101@columbia.edu

1 - Optimizing Strategic Safety Stock Placement in General Acyclic Networks
Sean Willems, Boston University, School of Management, 595 Commonwealth Ave., Boston, MA, 02215, United States of America, willems@bu.edu, Salal Humair

We present two enhancements to the guaranteed-service model for multi-echelon safety stock placement. First, we let each stage's expected inventory cost be a generalized non-concave non-closed form function of its incoming and outgoing service time. Second, we optimize the generalized cost model for directed acyclic networks. For the resulting NP-hard optimization problem, we present a provably optimal algorithm that runs within minutes for 29 chains from a data-set of 38 real-world chains.

2 - Assemble-to-order Systems with Exogenous Lead Times
Alp Muharremoglu, Columbia University, Graduate School of Business, New York, United States of America, alp2101@columbia.edu, Nan Yang

We study an ATO system with exogenous lead times under a component base stock policy. For the case of sequential lead times, we provide an efficient algorithm with polynomial complexity. We then proceed to develop efficiently computable upper and lower bounds for the general case of exogenous lead times, which includes i.i.d. and sequential lead times as special cases. We show that the bounds perform well numerically.

3 - Optimal Inventory Control in Market-Making with Risk Aversion
Miao Song, MIT, Cambridge, MA, 02139, United States of America, msong@mit.edu, David Simchi-Levi

Market-makers have the obligation to trade fixed amounts of assets at quoted bid or ask prices, and their inventories are exposed to the potential loss when the market price moves in an undesirable direction. One approach to reduce the risk associated with price uncertainty is to adjust the inventory at the price of losing potential spread gain. For a single-asset model, we show that a threshold inventory control policy is optimal for mean-variance analysis and exponential utility criterion. The mean-variance analysis for a multiple-asset model suggests that there exists a connected no-trade region and that the optimal strategy can be obtained from the no-trade region.

4 - The Final Order Problem for Repairable Spare Parts under Condemnation
Tarkan Tan, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Pav F7, Eindhoven, 5600 MB, Netherlands, t.tan@tue.nl, John van Kooten

We consider a manufacturer of complex machines that commits herself to repair failed spare parts throughout a service period. The suppliers of some spare parts discontinue production as technology advances and ask the manufacturer to place a final order. We address the final order problem for such repairable spare parts, which are subject to the risk of condemnation. We present a transient Markovian model and some approximations that allow us include further real-life characteristics.

■ MC39

H-Sapphire E, Fourth Floor

Operations Economics

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

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

Co-Chair: Gabriel Weintraub, Assistant Professor, Columbia Business School, New York, NY, 10027, United States of America, gyw2105@columbia.edu

1 - Large-scale Service Marketplaces
Gad Allon, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, IL, 60208, g-allon@kellogg.northwestern.edu, Eren Cil, Achal Bassamboo

In this paper, we study the behavior of the agents and customers in a large-scale service market-place. Our main goal is to discuss the role of the moderating firm in facilitating information gathering, operational efficiency, and communication among agents. Surprisingly, operational efficiency may be detrimental to the overall efficiency of the market-place. We show that to reap the gains of operational efficiency the firm may need to complement it by enabling communication among its agents.

2 - Empirical Analysis of a Procurement Combinatorial Auction
Gabriel Weintraub, gyw2105@columbia.edu, Daniel Yung, Rafael Epstein, Marcelo Olivares

We conduct an empirical investigation of bidding data in a large-scale combinatorial auction, which provides useful insights to improve the mechanism design. Using a unique data set on the Chilean combinatorial auction for school meals, we develop an estimation strategy to identify features of the firms' cost structure and competitive behavior. We use this information to suggest improvements to the current allocation mechanism.

3 - Pricing and Quality in Expert Services
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, M. Fazil Pac

In expert service markets consumers do not know the correct type of service they need; hence they rely on experts to identify the correct type of service. Arriving customers decide whether to join the service queue based on their beliefs on the diagnosis, offered price and the resulting equilibrium delay. We study pricing incentives in such services created by information asymmetry.

4 - The Timing of Capacity Investment by Start-ups and Established Firms in New Markets
Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, swinney_robert@gsb.stanford.edu, Serguei Netessine, Gerard Cachon

It is often observed that disruptive innovations (improvements in products or services that drastically change the functionality, cost, or intended market) are often ignored or marginalized by established firms and brought to market by start-up firms. We show that these dynamics can arise as a natural consequence of the competitive interactions of fundamentally different firms rather than as a consequence of failure on the part of the established firm.

■ MC40

H-Sapphire H, Fourth Floor

Portfolio Management

Sponsor: Financial Services
Sponsored Session

Chair: Koray Simsek, Assistant Professor of Finance, Sabanci University, Orhanli - Tuzla, Istanbul, 34956, Turkey, ksimsek@sabanciUniversityedu

1 - Comparing the Risk-Adjusted Performance of Dynamic Asset Allocation Strategies
Koray Simsek, Assistant Professor of Finance, Sabanci University, Orhanli - Tuzla, Istanbul, 34956, Turkey, ksimsek@sabanciUniversityedu

In an economy with stochastic interest rates and stochastic volatility of equity returns, we compare the risk-adjusted performance of dynamic investment strategies including portfolio insurance. More specifically, we look at buy-and-hold, fixed-mix, constant-proportion portfolio insurance (CPPI) and various option-based portfolio insurance (OBPI) strategies. Risk aversion is introduced via standard utility functions or risk-measures such as Conditional Value-at-Risk (CVaR).

2 - Optimal Trade Credit Decisions of a Start-up Firm
Preetam Basu, Student, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States of America, preetam.basu@business.uconn.edu, Suresh Nair

n business-to-business (B2B) trade, selling on credit is the convention. However, when a firm sells on credit there is the risk of losing money as its customers can go delinquent. Aggressive selling on credit can hurt the firm adversely at times of customer delinquency. On the other hand, not granting credit to customers leads to lost sales. In this paper, we focus on the trade credit policies of a start-up firm under random demand and explore the managerial implications of these decisions.

3 - Optimal Decision Making with Stochastic Cash Flows
Wei Chen, SAS institute Inc, Wei.Chen@sas.com

For many financial institutions, future cash flows constitute major areas of financial uncertainty. Traditionally, the asset and liability management functionality in financial institutions is mostly concerned with the interest rate risk under the static cash flow assumption. With the continued development of global financial markets additional risks, such as credit risk and prepayment risk, have become more significant in cash flow analysis. The fact that these risk types are typically stochastic in nature represents a considerable challenge to the risk management in financial institutions. This paper presents an optimization model that provides an optimal asset and liability allocation, using institutional profitability as a target, with stochastic cash flows. At the same time, new demands for market- consistent valuation require financial institutions to better value instruments which are not actively traded in the market. This, in turn, has renewed interest in the classical idea of a "replicating portfolio," It utilizes proxies to match cash flow streams for such instruments. The optimal asset and liability allocation model is extended with a proxy selection technique that minimizes the approximation error.

4 - On the Role of Norm Constraints in Portfolio Selection
Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, jgoto@indsys.chuo-u.ac.jp, Akiko Takeda

We examine the role of norm constraints in portfolio optimization from several directions. First, it is equal to a robust constraint associated with return uncertainty. Secondly, combined with the VaR/CVaR minimization, a nonparametric theoretical validation is posed based on the generalization error bound for the nu-SVM. Through experiments, the norm-constrained tracking error minimization with a parameter tuning strategy outperforms the traditional models in terms of the out-of-sample error.

5 - Log-robust Portfolio Management with Derivatives
Ban Kawas, Lehigh University, 200 W Packer Ave, Bethlehem, 18015, United States of America, bhk206@lehigh.edu, Aurelie Thiele

We present a robust optimization approach to portfolio management under uncertainty that incorporates the imperfect knowledge on the true distribution of the continuously compounded rates of return, in the case where the decision-maker can invest in European call or put options in a static model. We present a tractable formulation, theoretical insights and numerical results, and compare the strategy with the setting where derivatives are not allowed.

■ MC41

H-Sapphire L, Fourth Floor

An Interactive Panel/Audience Discussion: From PhD to Junior Faculty - Challanges and Opportunities

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Gal Raz, University of Virginia, Charlottesville, VA, 22903, razg@darden.virginia.edu

1 - An Interactive Panel/Audience Discussion: From PhD to Junior Faculty - Challanges and Opportunities
Moderator: Gal Raz, University of Virginia, Charlottesville, VA, 22903, razg@darden.virginia.edu, Panelists: Carrie Queenan, Burcu Keskin, Atalay Atasu, Amy Cohn, Ramesh Johari

In this interactive panel discussion, we will discuss the challenges and opportunities in the transition from a graduate student working on a PhD to a new faculty member. Panel members will discuss their experiences in making this transition and dealing with the issues faced by junior faculty at the beginning of their career including managing the balance between teaching and research. The members of the panel come from diverse backgrounds and experiences in different environments including business schools and Engineering departments as well as domestic (US based) and international schools. A large part of the panel will be dedicated to interactive discussion with the Audience.

■ MC42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice

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

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

1 - Hub Group Implements a Suite of OR Tools to Improve its Operations

Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

Hub Group developed a production decision support system which integrated forecasting, error distribution analysis, expected value based heuristics and optimization. The system was structured to fit within Hub's existing organizational structure, business processes and information technology to reduce project risk, cost and operational disruption. Hub improved its performance by $11 million in cost savings in the system's first year, improved revenue per load and increased container velocity.

2 - Extending Bass for Improved New Product Forecasting

Karl Kempf, Intel Corporation, 5000 W. Chandler Blvd., MS-CH3-10, Chandler, AZ, 85226, United States of America, karl.g.kempf@intel.com, Asima Mishra, Berrin Aytac, David S. Wu, Shamin A. Shirodkar, Mehmet O. Atan

Forecasting demand for new products is increasingly difficult as the technology treadmill drives product lifecycles shorter and shorter. We present a model that perpetually reduces forecast variance as new market information is acquired over time. Our model extends Bass's idea of product diffusion to a more comprehensive theoretical setting using the notion of demand-leading indicators in a Bayesian framework. Successful implementation at Intel demonstrates not only improvement in time/efforts but also reduction in forecast errors that leads to significant cost savings.

■ MC43

H-Room 400, Fourth Floor

Joint Session Supply Chain Models/ Operations Management/Marketing Interface: Coordinated Pricing and Operations Management

Cluster: Supply Chain Models
Operations Management/Marketing Interface
Invited Session

Chair: Xin Chen, Assistant Professer, University of Illinois, Industrial and Enterprise Sys. Eng., Urbana, IL, 61801, xinchen@illinois.edu

1 - Coordinated Pricing and Inventory Management with Reference Price Effect and Deterministic Demand

Xin Chen, Assistant Professer, University of Illinois, Industrial and Enterprise Sys. Eng., Urbana, IL, 61801, xinchen@illinois.edu, Peng Hu, Simai He

We analyze a finite horizon coordinated pricing and inventory model in which demand at each period depends not only on the current price but also on past prices through reference prices. The firm's objective to maximize its total profit by designing a proper pricing and ordering plan. We develop strongly polynomial time algorithms to solve several special cases of this problem. For the general case, a heuristic is proposed with an error bound estimation.

2 - Coordinated Pricing and Inventory Management with Reference Price Effect and Stochastic Demand

Yuhan Zhang, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, United States of America, yzhang30@illinois.edu, Xin Chen

We analyze a single product periodic review model in which pricing and production/inventory decisions are made simultaneously. Demands in different periods are random and depend on not only the current selling price but also a memory-based reference price. Pricing and ordering decisions are made at the beginning of each period, and all shortages are backlogged. The objective is to maximize expected profit over either a finite horizon or an infinite horizon. We prove that a reference price dependent base-stock list price policy is optimal even though the single period expected profit may not be concave. In the infinite horizon case, we further show that in the optimal trajectory, reference price converges to a steady state and provide a characterization.

3 - On the Structure of Joint Inventory-pricing Control with Positive Leadtimes

Zhan Pang, Research Associate, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, zhan.pang@utoronto.ca, Youhua Chen, Youyi Feng

We consider the joint inventory-pricing control problem for a single-item inventory system with positive leadtimes and multiple outstanding orders. The system state consists of inventory level and a pipeline of outstanding orders. By using a transformation techique and the notion of L-natural concavity, we are able to partially characterize the structure of the optimal inventory and pricing policy. We also generalize our analysis to the cases of serial systems and stochastic leadtimes.

4 - Robust Pricing with Two Substitutable Products

Zhi-Long Chen, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@rhsmith.umd.edu, Ming Chen

We study a markdown pricing problem with two substitutable products. Given limited demand information, our goal is to find a robust pricing scheme over time so that the worst-case performance is optimized. We propose a dynamic programming approach which can find optimal solutions for two special cases in a reasonable amount of time. For a more general case, we propose an approximation scheme.

■ MC44

H-Room 402, Fourth Floor

Panel Discussion: Service Research & Innovation

Sponsor: Service Science
Sponsored Session

Chair: Kris Singh, Strategic Programs Director, IBM Research, IBM ARC, 650 Harry Road, San Jose, CA, 95120, United States of America, KrisSingh@us.ibm.com

1 - Service Science- What & How

Moderator: Kris Singh, Strategic Programs Director, IBM Research, IBM ARC, 650 Harry Road, San Jose, CA, 95120, United States of America, KrisSingh@us.ibm.com

Panel Chair: Kris Singh, President, SRII, Strategic Programs Director, IBM Research. Panel Members: Lori Brownell, General Manager, Microsoft; Ram Akella, Professor, UC santa Cruz, CA; Kate Johnson, VP, Service Engineering, Oracle Corp, CA

■ MC45

H-Room 410, Fouth Floor

The Role of Incentives and Behavior in New Product Innovation Projects

Cluster: New Product Development
Invited Session

Chair: Vish Krishnan, Professor, University of California, Rady School of Manageme, 9500 Gilman Drive MC 0553, La Jolla, CA, 92037, United States of America, vkrishnan@ucsd.edu

1 - The Effects of Implicit and Explicit Incentives on NPD Portfolio Selection

Stylianos Kavadias, Associate Professor, Georgia Institute of Technology, 800 W. Peachtree Street, Atlanta, GA, 30308, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Jeremy Hutchison-Krupat

A firm portfolio of new product initiatives is widely recognized as a key ingredient to the long-term success. However past research has overlooked an important aspect: defining a portfolio of initiatives can not be equated to choosing from a menu. We recognize that such initiatives are defined by and within the organization, and we shed light on how incentives (implicit and explicit), information asymmetry and the risk associated with the initiative, affect the resulting portfolio.

2 - Managing Projects with Present-Biased Agents

Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg, Karthik Ramachandran, Vish Krishnan

This study analytically examines the project team-level effects of a common individual bias in inter-temporal decision making, the present bias, which causes workers to leave more work for later completion. We develop key managerial insights about the magnitude and timing of project payments, constitution of the project team and the management of information asymmetry among such agents, and discuss the implications of our analysis and results for managers of different types of projects.

■ MC46

H-Room 411, Fourth Floor

Perspectives on Technology Development and Diffusion

Sponsor: Technology Management
Sponsored Session

Chair: Andrew Nelson, Asst Prof of Management, University of Oregon, Lundquist College of Buinsess, Eugene, OR, 97405, United States of America, ajnelson@uoregon.edu

1 - Antagonism, Aesthetics and Mimesis: The Institutional Failures of Aerodynamic Bicycle Technology
Ralph Maurer, Visiting Asst Professor, Freeman College of Business, Tulane University, 1817 Homer Street, Metairie, LS, 70005, United States of America, rmaurer@mac.com

This paper examines a failure of institutional entrepreneurship from the field of professional bicycle racing. I chart the introduction of new aerodynamic bicycle technologies over the last thirty years and the subsequent stifling by the international governing body for professional cycling, the Union Cycliste Internationale. Analysis reveals three social mechanisms that potentiate the failure of innovators to reshape institutions in their favor.

2 - Cognitive Flexibility: The Adaptive Reality of Concrete Organization Change
Nathan Furr, Assistant Professor, Brigham Young University, 660 TNRB, Provo, UT, 84604, United States of America, nfurr@byu.edu

The question of why some organizations change when others do not is of central interest. Recent case-based literature suggests cognitively flexible organizations are more likely to change. This study investigates the impact of three core constructs that contribute to cognitive flexibility,Ä'variety, novelty and framing,Ä'on when organizations change their technology. I examine these three constructs at the team and organization level on the likelihood of three degrees of technical change.

3 - Knowledge Diffusion, Technology Transfer, and the Challenge of Assessment
Andrew Nelson, Asst Prof of Management, University of Oregon, Lundquist College of Buinsess, Eugene, OR, 97405, United States of America, ajnelson@uoregon.edu

While "knowledge diffusion" is a popular topic, its study has been shaped by the conflation of "knowledge diffusion" with "technology transfer," particularly as the latter is concerned with engineering and science. In this paper, I present data showing that dominant operationalizations of diffusion through the limited lens of technology transfer obscure important diffusion channels, processes and influences, while altering perceptions of active individuals and organizational reach/impact.

4 - Breaking the Ivory Tower: Academic Entrepreneurship in the Life Sciences in UK and Germany
Jeannette Colyvas, Asst Professor, Human Development and Social Policy, Northwestern University, colyvas@sesp.northwestern.edu, Carolin Haessler

We examine engagement in commercial activities and different forms of technology transfer (consulting, patenting, and founding) among more than 2,200 German and UK life scientists. We test hypotheses that include attributes of individuals, their material and social resources, and perceptions about values and reputation. We find that characteristics reflecting the existing social structure of science are strong predictors for a greater breadth of participation in academic entrepreneurship, but not for all forms of technology transfer. Our findings also suggest that while, in practice, science and commerce go hand in hand, normative orientation still holds strong in shaping entrepreneurial involvement.

■ MC47

H-Room 412, Fourth Floor

Tutorial: Multiple Objective Decision Analysis Involving Multiple Stakeholders

Cluster: Tutorials
Invited Session

Chair: L. Robin Keller, Professor, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, LRKeller@uci.edu

Co-Chair: Jay Simon, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, Monterey, CA, 93940, United States of America, jrsimon@nps.edu

Co-Chair: Yitong Wang, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, YWang07@merage.uci.edu

1 - Multiple Objective Decision Analysis Involving Multiple Stakeholders
L. Robin Keller, Professor, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, LRKeller@uci.edu, Jay Simon, Yitong Wang

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

■ MC48

H-Sapphire Green Room, Fourth

Operational and Financial Issues in Service Management

Cluster: Service Operations Management
Invited Session

Chair: Saravanan Kesavan, Assistant Professor, University of North Carolina, CB #3490, McColl Building, Chapel Hill, 27516, United States of America, skesavan@unc.edu

1 - The Impact of Device Standardization on Outcomes in Hip Replacement Surgery
Kamalini Ramdas, Professor, London Business School, kramdas@london.edu, Steven Stern, Haiyan Liu, Khaled Saleh

While component standardization has been researched a great deal in manufacturing settings, it is also applicable to services. In this paper we examine the impact of device standardization on outcomes in hip replacement surgery, using data from the University of Virginia Hospital.

2 - The Effect of Unit Managers on Unit Performance: A Longitudinal Study
Zeynep Ton, Harvard Business School, Morgan Hall 425, Boston, MA, 02163, United States of America, zton@hbs.edu, Dennis Campbell

How much do unit managers affect their units' operational and financial performance? Does the effect on performance differ for centralized versus decentralized organizations? We explore these questions by examining unit manager movements within multiple retail chains.

3 - Capacity Competition in Multi-indentured Service Supply Chain
Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

We study a setting in which multiple firms providing different components of a product face investment decisions that impact after-sales service performance. In particular, each component provider can invest in either service capacity or spare parts inventory. A product-level service requirement demanded by the customer creates an externality among firms that drives strategic behavior. We contrast between the efficiencies of two commonly observed contracts under this environment.

4 - The Impact of Labor and Traffic on Store Performance
Olga Perdikaki, Assistant Professor, Texas A&M University, 4217 TAMU, College Station, 77843-4217, United States of America, operdikaki@tamu.edu, Saravanan Kesavan, Jay Swaminathan

We use proprietary data from a retailer to examine the impact of labor, intra-day traffic variability, and traffic uncertainty on two store performance measures: conversion rate and basket value. We find that increase in intra-day traffic variability is associated with a decline in conversion rate and basket value and increase in traffic uncertainty is associated with a decrease in conversion rate but not basket value.

■ MC49

H-Room 300, Third Floor

Workforce Scheduling in Call Centers

Cluster: Workforce Engineering and Management
Invited Session

Chair: Mehmet Yasin Ulukus, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, myu1@pitt.edu

1 - Optimal Balanced Control for Call Centers
Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl, Bernd Heidergott, Taoying Yuan, Dinard Laan, van der

Efficient workforce management needs to determine the scheduling and routing of calls simultaneously. This is a complex problem, especially when different customer classes have conflicting objectives. We look at mixtures of policies, which are known to benefit each individual customer class. We show that balanced sequences in combination with a stochastic gradient method outperform straightforward randomization of policies. The effectiveness is illustrated for a call center with call blending.

2 - Performance Models of a Single-skill Call Center
Oualid Jouini, Assistant Professor, Ecole Centrale Paris, Laboratoire Genie Industriel, Grande Voie des Vignes, Chatenay-Malabry, 92290, France, oualid.jouini@ecp.fr, Ger Koole

We consider a single-skill call center including abandonments. We focus on different service level definitions related to queueing delays. We show how these performance definitions, which are used in practice, can be modeled and calculated. We also gain additional insights from simulations.

3 - Dealing with Service Level Variability in Call Centers
Ger Koole, VU University Amsterdam, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, koole@few.vu.nl, Christian van Delft, Shuangqing Liao

Agent scheduling in call centers is done by solving a deterministic optimization problem, the only randomness is implicit in the Erlang formula. In this talk we discuss other types of randomness and discuss implications for agent scheduling.

4 - Agent Scheduling at Call Centers
Turgut Aykin, President, ac2 Solutions, 1090 King Georges Post Rd., Suite 305, Edison, NJ, 08837, United States of America, taykin@ac2solutions.com

This presentation provides a review of the approaches available for the agent scheduling problem at call centers. Complexities found in scheduling agents at large call centers are discussed together with the implications of skills-based routing. Computational results from several large call center organizations are reported.

■ MC50

H-Room 302, Third Floor

Hole in One: Using Operations Research to Analyze Golf II

Sponsor: SpORts
Sponsored Session

Chair: Douglas Fearing, MIT, Operations Research Center, Cambridge, MA, 02139, United States of America, dfearing@mit.edu

1 - Analyzing Situational Golfer Performance Using Putts Gained
Douglas Fearing, MIT, Operations Research Center, Cambridge, MA, 02139, United States of America, dfearing@mit.edu, Stephen Graves, Jason Acimovic

In an earlier talk, we developed a method of estimating putts-to-go and subsequently putts gained. In this talk, we utilize the putts gained metric to analyze situational golfer performance. First, we investigate the breakdown of on and off-green performance to demonstrate how different golfers pick up strokes. Next, we analyze putts gained across two situational slices of the PGA Tour's ShotLink data: putting for birdie vs. par and final round putting.

2 - Scramble Teams for the Pinehurst Terrapin Classic
Michael Ball, Robert H Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, mball@rhsmith.umd.edu, Russell Halper

The Pinehurst Terrapin Classic (PTC) is a 5-day, 16-player, annual golf tournament that includes both match-play and scramble rounds. We study how to create a schedule that ensures 1) that every pair of players is on the same team at least once and 2) that the teams are balanced. We are able to optimize team balance using a very compact integer program.

3 - Going for the Green: A Simulation Study of Qualifying Success Probabilities in Professional Golf
Richard Rendleman, University of North Carolina, Kenan-Flagler Business School, Richard_Rendleman@unc.edu, Robert Connolly

Each year, over a thousand golfers attempt to qualify for a PGA Tour card through Q-School. Our simulation model quantifies the probability that the Q-School correctly identifies high-skill golfers. We calibrate our model to account for variation in individual golfer skill over time and differences in skill across various groups of golfers attempting to qualify. We show that the very best players qualify, but players equal in skill to top-100 PGA Tour members have low odds of qualifying.

■ MC51

H-Room 303, Third Floor

Computational Optimization and Applications

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

Chair: Yongpei Guan, Assistant Professor, Department of Industrial and Systems Engineering, University of Florida, Gainesville, FL, 32611, United States of America, guan@ise.ufl.edu

1 - Computational Study on Lifted Cuts Using Multidimensional Superadditive Lifting Method
Bo Zeng, Assistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, Fl, 33620, United States of America, bzeng@eng.usf.edu, Jean-Philippe Richard

Strong cutting planes could be obtained by applying multidimensional superadditive lifting method on multiple constraints. We present a set of computational results to demonstrate the effectiveness of those cuts on solving 0-1 mixed integer programs.

2 - Variable Space Exploration for NLP
John Chinneck, Professor, Carleton University, Department of Systems & Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca, Laurence Smith

Running a local NLP solver can be expensive. It is more efficient to first explore the variable space using inexpensive methods to find promising points from which to launch the local solver. We describe our recent work on voting and other social methods for choosing good NLP solver launch points.

3 - A Stochastic Programming Approach in Supply Disruption Management
Lei Zhao, Assistant Professor, Department of Industrial Engineering, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, lzhao@tsinghua.edu.cn, Ruiwei Jiang, Shanshan Guo

We explore the impact of supply uncertainty on production planning and model its mitigation solution as a stochastic program. We then study the trade-off between the cost of mitigation and the expected cost when supply disruptions may happen during the production.

4 - A Computational Study of the Maximum K-club Problem
Balabhaskar Balasundaram, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, baski.balasundaram@okstate.edu, Foad Mahdavi Pajouh

A k-club is an induced subgraph of diameter at most k. This defines a clique when k equals one. While every subset of a clique is also a clique, every subset of a k-club is not necessarily a k-club for k larger than one. This nonhierarchical property creates interesting challenges for optimization algorithms to find large k-clubs. This talk will outline these challenges, present a combinatorial branch-and-bound algorithm and a computational study of this problem.

■ MC52

H-Room 304, Third Floor

Marketing Strategies in Supply Chain Management

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Wenjing Shen, Assistant Professor, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, ws84@drexel.edu

1 - Lower Bounds and Heuristics for Supply Chain Allocation
Kai Rosling, Professor, Växsö University, TD, Växsö, SE-35195, Sweden, kaj.rosling@vxu.se, Johan Marklund

N retailers are replenished more often than their central warehouse. For large N, the stationary problem is optimized by zero warehouse safety stock and retailer order-up-to levels that decrease through the warehouse order cycle. Computations require feasibility on the average only, which creates a lower bound better than Clark&Scarf, except for small N. For finite N, the policy outperforms Jackson's (1988) stationary heuristic.

2 - Salesperson Compensation Scheme in a Supply Chain
Neda Ebrahimy, PhD Candidate, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, 60208, United States of America, neda@u.northwestern.edu, Hyo duk Shin, Mark Daskin, Seyed Iravani

We explore different salesperson compensation schemes in a supply chain with an upstream manufacturer and a downstream retailer. Investigating salesperson's incentive to put efforts to increase consumer demand, we demonstrate the impact of contracts between the parties within a supply chain on each firm's profits and total surplus.

3 - Strategically Sharing Demand Information in Competing Supply Chains
Hongtao Zhang, Associate Professor, HKUST, Clear Water Bay, Kowloon, Hong Kong - PRC, imhzhang@ust.hk

Two competing supply chains, each with a manufacturer and a retailer. A retailer conducts market research which may not be successful. If it is, the retailer can disclose the finding to its manufacturer. Uncertainty in market research enables a retailer to credibly conceal high-demand news. We consider the impact of research capability and retail competition. Less information is disclosed if retail competition is more intense. Retailers' market research capabilities are strategic complements.

4 - Examining Double Marginalization Effect for Innovative Products
Wenjing Shen, Assistant Professor, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, ws84@drexel.edu

Although double marginalization effect has been extensively studied, limited attention has been given to innovative products whose demand is generated through word-of-mouth effect. We study a supply chain that sells innovative products with pricing decisions and show that if profits are not discounted, then the supplier charges constant prices while retailer will dynamically change prices. Numerical results are provided to study the double marginalization effect under different settings.

5 - Examples Illustrating the Importance of Integrating Supply Chain and Revenue Management Activities
Peter C. Bell, Richard Ivey School of Business, University of Western Ontario, London, N6A 3K7, Canada, PBell@Ivey.ca

We examine two firms with traditional supply chain issues (excess capacity, high transportation costs, and highly seasonal demand) and show that these issues can be profitably resolved through marketing activities. We also show that management of these firms will likely make inappropriate strategic and tactical decisions unless their decision model includes both marketing and operations decision variables.

■ MC53

H-Room 305, Third Floor

Advances in Mixed Integer Programming II

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Santanu Dey, CORE, Louvain-La-Neuve, Belgium, Santanu.Dey@uclouvain.be

1 - Master Equality Polyhedron with Multiple Rows
Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca, Oktay Gunluk, Sanjeeb Dash

Master Equality Polyhedron (MEP) is a canonical set that generalizes the Master Polyhedron (MP) of Gomory and that can be used as a source of cutting planes for general mixed-integer programs and was recently studied for m=1 rows. In this work, we study the MEP when it is defined by m>1 rows. Unlike the MP, we show that a characterization of all facet-defining inequalities may not be as simple as when m=1. However, we show that separation can still be done efficiently in the cases m=2 and m=3.

2 - On the Relative Strength of Two Row Cuts for MILPs
Amitabh Basu, PhD Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15232, abasu1@andrew.cmu.edu, Gerard Cornuejols, Francois Margot, Pierre Bonami

Cutting planes generated from two rows of the optimal simplex tableau are of three types : splits, triangles and quadrilaterals. We compare the strength of these families of inequalities. We show that, in a well defined theoretical sense, triangle and quadrilateral inequalities provide a good approximation of the integer hull; whereas, the approximation produced by split inequalities may be arbitrarily bad. We will also give some experimental results showing the effectiveness of two row cuts.

3 - Flexible Isomorphism Pruning
James Ostrowski, University of Waterloo, jostrows@engmail.uwaterloo.ca, Jeff Linderoth, Francois Margot

Isomorphism Pruning is an extremely powerful symmetry breaking tool when applied to integer programs. However, Isomorphism Pruning has the limitation that the algorithm must use a restricted choice of branching variables during the search. In this talk, we show how remove this limitation—-modifying isomorphism pruning to allow for complete flexibility in the choice of branching variable. Computational results showing the benefit of this flexibility will be given.

4 - Decomposition of Multi-Period MIPs with Approximate Value Functions
Alejandro Toriello, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, atoriello@gatech.edu, George Nemhauser, Martin Savelsbergh

We investigate the possibility of generating good solutions to multi-period MIPs by solving single- or few-period subproblems linked by state variables. The tailing-off effect of shorter planning horizons is mitigated by a piecewise-linear concave approximate value function obtained via sampling and data fitting.

■ MC54

H-Room 306A, Third Floor

Online Optimization Problems

Sponsor: Optimization/Networks
Sponsored Session

Chair: Niv Buchbinder, Microsoft Research, 1 Memorial dr., Cambridge, MA, 02142, United States of America, nivbuchb@microsoft.com

1 - The Adwords Problem: Online Keyword Matching with Budgeted Bidders under Random Permutations
Nikhil Devanur, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States of America, nikdev@microsoft.com

We consider the problem of a search engine trying to assign a sequence of search keywords to competing bidders, each with a daily budget. The sequence of bids is revealed on-line. The goal is to maximize the revenue. If the keywords arrive in a random order, then we present an algorithm with a competitive ratio of 1-epsilon under some mild, but necessary, assumptions. In contrast, if the keywords arrive in an adversarial order, it is known that the best CR is bounded away from 1.

2 - Making Decisions: A New Technique
Jacob Abernethy, PhD Student, University of California at Berkeley, 387 Soda Hall, Berkeley, CA, 94720, jake@cs.berkeley.edu

To a large extent, there has been a significant divide between the online learning community and the online algorithms community. The Paging problem, as well as the related Metrical Task Systems problem, has generally been approached very differently than, for example, the problem of "competing with the best expert". I'll show a new technique, "Guess the Futureto solve the Paging and Experts problem optimally, and I'll conjecture that the approach is indeed much more general.

3 - Caching Problems - Online Algorithms Meet Linear Programming
Niv Buchbinder, Microsoft Research, 1 Memorial dr., Cambridge, MA, 02142, United States of America, nivbuchb@microsoft.com, Nikhil Bansal, Seffi Naor

We consider online algorithms for the generalized caching problem. Here we are given a cache of size k and pages with arbitrary sizes and fetching costs. The goal is to minimize the total cost of fetching the pages into the cache. We give an online algorithm with competitive ratio $O(\log^2k)$. We also give improved $O(\log k)$-competitive algorithms for several interesting special cases of the problem. Our algorithms are based on a novel primal-dual framework for online algorithms.

■ MC55

H-Room 306B, Third Floor

Procurement and Risk Management in Commodity Markets

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

1 - Inventory Control of Seasonal Storage Assets: Maximizing the Value of Limited Flexibility

Owen Wu, Assistant Professor, Ross School of Business, University of Michigan, Ann Arbor, owenwu@umich.edu, Derek Wang

The value of seasonal storage depends on both the seasonal commodity price and the operational flexibility. We characterize the optimal injection and withdrawal strategy for a natural gas seasonal storage. We find some counter-intuitive policies are actually optimal, e.g., even if the expiring futures contract price is the lowest on the forward curve and all futures prices are martingales, it might still be optimal to delay a portion of injection to capture the value of operational flexibility.

2 - An Approximate DP Approach to Benchmark Practice-based Heuristics for Natural Gas Storage Valuation

Guoming Lai, McCombs School of Business, University of Texas, Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, guomingl@andrew.cmu.edu, Nicola Secomandi, Francois Margot

The valuation of the real option to store natural gas is a practically important problem. Traders value this option heuristically because its exact valuation is at odds with the high-dimensional price evolution models that they use. We develop a novel and tractable approximate dynamic programming method that coupled with Monte Carlo simulation computes lower and upper bounds on the value of storage. We use these bounds to benchmark heuristics used in practice.

3 - Supply Management for Proportional Product Markets

Onur Boyabatli, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

Traditional (B2B) contracting models consider single homogenous product model where a single unit of input is processed to produce a single unit of output. In many commodity markets (such as fed-cattle, soybeans), one unit of input (beef) is processed to produce proportional amounts of multiple-outputs. We investigate the implications of the proportional product model on the optimal mix of long-term and short-term (spot) contracting decisions.

■ MC56

H-Room 307, Third Floor

New Trends in Optimization

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

Chair: Angelia Nedich, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, angelia@illinois.edu

1 - Testing the Nullspace Property Using Semidefinite Programming

Alexandre d'Aspremont, Princeton University, Dept of Operations Res & Fin Eng, Princeton University, Princeton, NJ, 08544, United States of America, aspremon@princeton.edu, Laurent El Ghaoui

Recent results in compressed sensing show that, under certain conditions, the sparsest solution to an underdetermined set of linear equations can be recovered by solving a linear program. Given a matrix A, we use semidefinite relaxation techniques to test the nullspace property on A and show on some numerical examples that these relaxation bounds can prove perfect recovery of sparse solutions with relatively high cardinality.

2 - Sparse Solutions of Standard Quadratic Programmimng Problems with Random Matrices

Jiming Peng, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, pengj@illinois.edu

In this talk, we investigate the properties of the solutions of the so-called standard quadratic programming problems (StQP), which has been proved to be NP-hard. Motivated by the recent results in compressed sensing, we focus on the scenarios where the associated matrix is random. We show that if all the elements of the underlying matrix follow i.i.d., then the corresponding StQP has a very sparse solution with a high probability.

3 - Online Learning and Interior Point Algorithms for MDPs with Expected Budget Constraints

Constantine Caramanis, The University of Texas at Austin, Austin, TX, cmcaram@ece.utexas.edu, Nedialko Dimitrov, David Morton

An MDP with n states can be solved using the value iteration algorithm in O(n^2) time, as opposed to the Omega(n^3) time required if one uses a linear program. Expected budget constraints on the MDP policy can be easily captured in a linear program formulation, but break the basic value iteration algorithm. We show two new algorithms for solving MDPs with k budget constraints giving the exact solution in O(poly(k) n^2) time or an approximately feasible solution in O(log(k) n^2) time.

4 - Distributed Asynchronous Stochastic Optimization Method

Angelia Nedich, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, angelia@illinois.edu

We consider a distributed method over a network for optimizing a convex objective function, which is known to all agents in the network. At any given time, one agent updates and passes its estimate to one of its neighbors according to a Markov chain distribution. We consider a gradient-based scheme, and establish some convergence properties and error bounds on the performance.

■ MC57

H-Room 308, Third Floor

Health Information Technology and Organization Transformation

Sponsor: Health Applications
Sponsored Session

Chair: Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

1 - Alert Management in Electronic Medical Record System

Amanda Mejia, Graduate Research Assistant, Georgia Institute of Technology, 609 Virginia Ave NE #4104, Atlanta, GA, 30306, United States of America, mandy.mejia@gatech.edu, Eva Lee

This work focuses on analyzing EPIC alert data to identify opportunities to filter medication alerts in order to reduce alert fatigue and improve quality of care. Our analysis will focus on 6 months of data to characterize types of alerts and recommend potential filters for alerts reduction. Validation of the benefits of these filters will be tested. This project is led by Dr Lee with collaboration with clinical leaders from Children's HealthCare of Atlanta.

2 - Absorptive Capacity for Transformative Initiatives in Two Health Systems

Bita Kash, BAKASH@SRPH.TAMHSC.EDU, Aaron Spaulding, Christopher Johnson, Larry Gamm

The paper reports on development of a research framework and measurement model of absorptive capacity (ACAP) for transformations in healthcare systems. Tapping ACAP via a survey for organizational participants—administered before, during, and after a transformation effort— will examine a two-way relationship between ACAP and current and future transformations.

3 - Reducing Medication Error

Deniz Cinalioglu, Grad Student, Georgia Tech, Atlanta, GA, 30332, dcinalioglu3@gatech.edu, Hyojung Kang, Eva Lee, Sudhan Chinnappan

In this talk, we will focus on high alert medication administration. Medication process flow in 3 units across two hospitals will be described. Reports on time-motion study on the administering process, and simulation of the medical process will be presented. Potential intervention and mitigation strategies will be analyzed. This project is led by Dr. Lee with collaboration with clinical leaders from Children's HealthCare of Atlanta.

4 - Multi-Project Mapping in Organizational Transformation: Cross Project Interdependency Mapping and Differential Dependence on Organizational Technologies in Two Health Systems

Larry Gamm, Gamm@srph.tamhsc.edu, Bita Kash, Christopher Johnson, Aaron Spaulding

The paper present a mapping model of interdependencies among multiple transformation projects within two large health systems, assessing the relative reliance of projects and their interdependencies upon four organizational technologies. The research relies primarily upon approximately 60 interviews containing both narrative and numeric responses to standard interview items.

■ MC58

H-Room 309, Third Floor

Models and Solutions for Logistics and Scheduling

Cluster: Scheduling
Invited Session

Chair: Chung-Lun Li, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China, lgtclli@polyu.edu.hk

1 - Repairable Inventory Optimization of an Item with New and Warranty Demand Sources

Yizhong Lin, The Chinese University of Hong Kong, SEEM Dept, CUHK, Shatin, Hong Kong, Hong Kong - PRC, yzlin@se.cuhk.edu.hk, Janny Leung

We consider a multi-period single-product repairable inventory problem. We concern issues on perfect substitution of instantaneous supply sources (purchasing new and repairing returns), demand (new and warranty) priority and relationship between warranty demand and repairable returns. We prove the optimal replenishment and disposal policies raised by Simpson (1978) still hold.

2 - An Improved Approximation Algorithm for Multiple Depot Traveling Salesman Problem

Zhou Xu, Assistant Professor, The Hong Kong Polytechnic University, lgtzx@inet.polyu.edu.hk, Brian Rodrigues

We present an improved approximation algorithm for an important extension of the classical traveling salesman problem (TSP), with multiple vehicles located at multiple depots. Our approximation algorithm runs in polynomial time when the number of depots is a constant, and achieves a performance ratio of 3/2, which is the best ratio that one can expect unless the classic TSP has an approximation algorithm superior to the well-known Christofides heuristic.

3 - A Fast Preemptive Scheduling Algorithm with Release Times and Inclusive Processing Set Restrictions

Joseph Leung, Distinguished Professor, New Jersey Institute of Technology, Department of Computer Science, Newark, NJ, 07102, United States of America, leung@oak.njit.edu, Yumei Huo, Xin Wang

We consider the problem of preemptively scheduling n jobs on m machines so as to minimize the makespsn. Each job has a processing time and an eligible machine set. The eligible machine sets are inclusive. We give an $O(nk \log P + mk^2 + m^3k)$-time algorithm, where k is the number of distinct release times and P is the total processing time of all jobs.

4 - Polyhedral Analysis of an Evacuation Planning Problem

Emrah Cimren, The Ohio State University, Integrated Systems Engineering, 1971 Neil Ave, Columbus, OH, 43210, United States of America, cimren.1@osu.edu, Marc Posner

We consider the polytope of an inequality with continuous and binary variables with upper bounds. This polytope arises as a sub-problem of large scale MIP models of real life problems such as railroad scheduling and evacuation planning. The polyhedral structure of the convex hull of the polytope is investigated. We introduce a family of facet-defining valid inequalities and develop a sequence independent lifting procedure.

■ MC59

H-Room 310, Third Floor

Tutorial: Innovation and Product Development

Cluster: Tutorials
Invited Session

Chair: Christian Terwiesch, Professor, The Wharton School, 548 JMHH, Philadelphia, PA, 19104, United States of America, terwiesch@wharton.upenn.edu

1 - Innovation and Product Development

Christian Terwiesch, Professor, The Wharton School, 548 JMHH, Philadelphia, PA, 19104, United States of America, terwiesch@wharton.upenn.edu

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

■ MC60

H-Room 311, Third Floor

The Rise and Fall and Rise Again of Interior-Point Methods

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Margaret Wright, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, 10012, United States of America, mhw@cs.nyu.edu

1 - Then and Now: The Renaissance of Interior-Point Methods for Nonlinear Programming Part 1

Margaret Wright, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, 10012, United States of America, mhw@cs.nyu.edu

The 1984 "interior-point revolution" in optimization could equally well be called an "interior-point renaissance" because of its interconnected combination of old and new ideas. The two speakers will address several themes, including: the pre-1984 rise and fall of interior-point methods; old ideas that have been revived and extended; and genuinely new ideas related to computational complexity, ties with linear algebra, and approaches for large-scale problems.

2 - Then and Now: The Renaissance of Interior-Point Methods for Nonlinear Programming Part 2

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

The 1984 "interior-point revolution" in optimization could equally well be called an "interior-point renaissance" because of its interconnected combination of old and new ideas. The two speakers will address several themes, including: the pre-1984 rise and fall of interior-point methods; old ideas that have been revived and extended; and genuinely new ideas related to computational complexity, ties with linear algebra, and approaches for large-scale problems.

3 - Interior Point Methods for Very Large Scale Optimization 25 Years Later

Jacek Gondzio, Prof, Edinburgh University, School of Mathematics, Edinburgh, EH9 2EA, United Kingdom, J.Gondzio@ed.ac.uk

This talk will focus on remaining challenges faced by interior point methods for very large scale optimization. In particular, the issues of iterative methods and a choice of suitable preconditioners to solve reduced Newton systems arising in optimization with interior point methods will be addressed.

■ MC61

H-Room 312, Third Floor

New Location Models with Capacity, Closest Assignment or Time-window Constraints

Sponsor: Location Analysis
Sponsored Session

Chair: Leyla Ozsen, Assistant Professor, San Francisco State University, 1600 Holloway Ave., Business Building, San Francisco, CA, 94132, United States of America, leyla_ozsen@mac.com

1 - Generalized Constraints for Closest Assignment in Location Modeling

Richard Church, Professor, Department of Geography, University of California Santa Barbara, Santa Barbara, United States of America, church@geog.ucsb.edu, Ting Lei

Special constraints are needed to enforce closest assignmnet allocation in many location problems including the budget constrained p-median problem and the weighted benefit covering problem. Over the past few decades four major types of constraint structures have been proposed to force closest assignment. This paper shows how each structure can be generalized to handle multi-level problems as well as presents an application of these constraints to a multi-level interdiction problem.

2 - Warehouse Capacity-Acquisition Location Models

Nayoung Cho, Department of Management Sciences, The University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242-1000, United States of America, chon@purdue.edu, Leyla Ozsen

We study a warehousing network design problem for a two-stage and single product supply chain with stochastic demand. Our objective is to determine the capacity and location of warehouses and the retailer-warehouse assignments that minimize the sum of the capacity, transportation, ordering, and inventory costs across the whole supply chain. For various types of capacity acquisition cost functions, we propose solution methodologies based on Lagrangian Relaxation.

3 - Optimizing Distribution with Time Windows and Service Modes for a Candy Supply Chain
Zeliha Akca, PhD Candidate, Lehigh University, Industrial & Systems Eng., 200 W. Packer Ave, Bethlehem, PA, 18015, United States of America, zelihaakca@lehigh.edu, Larry Snyder

We develop a MIP model to optimize the distribution network of the candy company Just Born. The model determines distribution centers and service mode (direct vs. LTL) for each demand and constructs shipment schedules and vehicle routes based on time windows. We extend the model with a set of new variables and valid inequalities. We improve the optimization process with an upper bound based on the LP relaxation. We empirically demonstrate the effectiveness of the model on real world instances.

■ MC62

H-Room 313, Third Floor

Capturing Human Behavior with System Dynamics Models

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch

1 - Managing R&D Pipeline Performance: Evidence From the Pharmaceutical Industry
Paulo Figueiredo, Boston University, paulof@bu.edu, Nitin Joglekar, Stephen Rosenthal

Key decisions in a R&D pipeline are: screen thresholds, complexity of projects, global and local resource allocation biases while adjusting capacity. We explore the impact of structural and behavioral aspects of these decisions through a simulation based analysis of a pharmaceutical dataset. Results establish concave relationships between value created at the end of pipeline and the resource allocation and complexity allocation biases, indicating a limit for front loading practices.

2 - In Search of the Bullwhip: The Credit Crisis
Jan Fransoo, Professor, Eindhoven University of Technology, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, J.C.Fransoo@tue.nl

After the collapse of Lehman brothers, substantial drops in demand were observed by many manufacturing companies. Empirical material supports our hypothesis this has been largely due to destocking, causing a severe global bullwhip. We deploy a straightforward system dynamics model and attempt to predict the recovery process. We predict the Summer/Fall 2009 recovery, but also a fallback in early 2010.

3 - Impact of Shortages on Single-supplier Multi-retailer Supply Chain
Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch, Santiago Arango

We investigate through a set of experiments the impact that individual and locally rational decisions of suppliers and retailers has on supply chain performance, in a single-supplier multi-retailer supply chain constrained by supply shortages.

■ MC63

H-Room 314, Third Floor

Health Care Logistics

Contributed Session

Chair: Raja Jayaraman, Post Doctoral Fellow, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu

1 - Physician Learning and the Healthcare Supply Chain
Cara Dienes, Iowa State University, 3038 Black Engr., Ames, IA, 50014, United States of America, cdienes@iastate.edu, John Jackman

Physician preference items are a key component of healthcare supply costs, due in part to the high rate of technological change that these supplies are subject to. This work models the relationship between the device manufacturer and the physician using game theory, in order to understand how the physician's learning and the manufacturer's time-pacing and product rollover decisions interact.

2 - Opportunities for Improvements in Healthcare Logistics Revealed
Brian Smith, Graduate Research Assistant, University of Arkansas, Department of Industrial Engineering, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bks07@uark.edu, Heather Nachtmann, Ed Pohl

Research has shown that the healthcare supply chain is an area with great potential for cost and quality improvements. In 2008, we surveyed over 1,350 healthcare supply chain professionals to investigate the state of the healthcare supply chain. The survey responses are analyzed to understand and report the impact of cost inefficiencies and identify opportunities for improving the quality of healthcare delivery. These results are presented here.

3 - Service Level, Ordering/Holding Cost and Capacity Tradeoffs for Pharmaceutical Inventories
Peter Kelle, Professor, Louisiana State University, 3195 Taylor Hall, ISDS Department, Baton Rouge, LA, 70803, United States of America, qmkell@lsu.edu, Helmut Schneider, Sonja Wiley-Patton, John Woosley

We provide simple, close to optimal rules for the safety stock and cycle stock allocation under space constraint for pharmacy inventories. We analyze the tradeoffs among the service level (emergency refill workload), ordering cost (refill workload), holding cost, and the available space (depending on the variety of drugs' formulary).

4 - Technology Requirements for Adoption of Healthcare Supply Chain Data Standards
Raja Jayaraman, Post Doctoral Fellow, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu, Ronald L. Rardin, Nebil Buyurgan, Anglelica Burbano

Proposed data standards offer unambiguous identification of goods and trading partners across the healthcare supply chain. The materials, inventory, IT and clinical systems require a variety of changes to implement data standards. In this presentation we shall highlight some of the unique technology support challenges and its realized benefits.

■ MC64

H-Room 202A, Second Floor

Panel Discussion: Advising Undergraduate Research

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Moderator: Susan E Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Blvd., Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

1 - Undergrad RAs at a Research University
Panelist: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

I will talk about my experiences supervising undergraduate research projects in Industrial and Operations Engineering at the University of Michigan.

2 - Advising Undergraduate Research
Panelist: Kevin Hutson, Associate Professor, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, kevin.hutson@furman.edu

Advising undergraduate research at liberal arts colleges can be difficult since, often, these students have to invest a large portion of their freshman and sophomore years taking general education requirements and have very little exposure to operations research. Here I discuss my experiences (both successful and disasterous) advising summer research in operations research with liberal arts mathematics students.

3 - Advising Summer Research Experiences at a Small College
Panelist: Mike Veatch, Gordon College, 255 Grapevine Rd, Wenham, MA, 01984, United States of America, mike.veatch@gordon.edu

4 - Undergraduate Senior Experiences in OR
Panelist: Allen Holder, Rose-Hulman Inst. of Tech., 5500 Wabash Ave., Terre Haute, IN, 47803, United States of America, holder@rose-hulman.edu

The capstone/senior experience is common in undergraduate curricula, and we will discuss the qualities that comprise a positive experience. In particular, we will highlight the favorable role OR plays across the undergraduate experience in math, science, and engineering.

■ MC75

C-Room 32A, Upper Level

Railroad Capacity Planning Session I

Sponsor: Railroad Applications
Sponsored Session

Chair: Clark Cheng, Sr. Manager Operations Research, Norfolk Southern Corp., 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, Clark.Cheng@nscorp.com

1 - LineMAX: Line Capacity Analyzer at Norfolk Southern
Vinay Mehendiratta, Operations Research Analyst, Norfolk Southern, 1200 Peachtree St, Atlanta, GA, 30309, United States of America, vinay.mehendiratta@nscorp.com, Pete Murgas

We describe the development and application of a Line Capacity Model at Norfolk Southern Railroad (NS) for use in evalution of capacity issues. The model uses meet pass optimizer to calculate the capacity of a line segment and takes train schedule of scheduled trains, method of operations, train types and priorities, and infrastructure into consideration.

2 - Capacity Planning and the Total Service Integration Process at CSX
Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com, Gabriel Farra, Chuck Martin

Managing capacity on the line of road and at terminals is a challenge on single track high density line segments. The process of improving capacity is defined and has various approaches to addressing the shortfalls, however linking these improvements with how access is gained to the line segments can make planning much more proactive and improvements more effective.

3 - Dispatching System Developments at BNSF Railway
Roger Baugher, Director, Interline and Special Projects, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States of America, roger.baugher@bnsf.com

BNSF Railway is developing new user interfaces to improve the planning of meets and passes. The systems will be described and demonstrated.

Monday, 4:30pm - 6:00pm

■ MD01

C-Room 21, Upper Level

Decision Analysis Society Awards

Sponsor: Decision Analysis
Sponsored Session

Chair: Jack Kloeber, Kromite LLC, 12 Penns Trail, Newtown, PA, 18940, United States of America, jkloeber@kromite.com

1 - Student Paper Award
Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu

The Student Paper Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the Decision Analysis Society of INFORMS. We will recognize the finalists, and the winning paper will be presented.

2 - DA Publication Award
Rakesh Sarin, UCLA, The Anderson School, Los Angeles, United States of America, rakesh.sarin@anderson.ucla.edu

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

The DAS Practice Award is given annually to the best application of decision analysis, as judged by a panel of decision analysis academics and practitioners. We will recognize the finalists and the winner.

4 - Frank P. Ramsey Medal
Robert Winkler, Fuqua School of Business, Duke University, Durham, NC, 27708-0120, United States of America, rwinkler@duke.edu

The Frank P. Ramsey Medal is the highest award of the Decision Analysis Society, and it recognizes distinguished contributions to the field of decision analysis. The medal is named in honor of Frank Plumpton Ramsey, a Cambridge University mathematician who was one of the pioneers of decision theory in the 20th century.

■ MD02

C-Room 22, Upper Level

Decision Analysis I

Contributed Session

Chair: Gurcan Bicken, Dir. of Pricing and Product Opt., Autozone, 123 S Front St, Memphis, TN, United States of America, gurcan.bicken@gmail.com

1 - K-Distributions: A Galaxy of New Probability Distributions With Assessed-Fractile Parameters
Tom Keelin, Managing Partner, Keelin Reeds Partners, 800 Menlo Avenue, Suite 210, Menlo Park, CA, 94025, United States of America, tomk@keelinreeds.com, Brad Powley

This paper introduces a new class of probability distributions for flexibly and accurately representing uncertainty. K-distributions promise to revolutionize decision analysis (DA) by providing easy-to-use continuous distributions that exactly reflect assessed fractiles, have desirable smoothness properties, make 3-branch discrete approximations of continuous uncertainties unnecessary, are easy to simulate, and that overall make DA simpler, easier, faster, more accurate, and more fun.

2 - K-Distributions: Characterization and Exploration
Brad Powley, PhD student, Stanford University / Management Science & Engineering, Terman Engineering Center, 380 Panama Way, Stanford, CA, 94305, United States of America, bpowley@stanford.edu, Tom Keelin

K-Distributions are a new class of probability distributions that facilitate uncertainty representation and processing in decision analysis. K-Distributions with simple functional forms have the flexibility to represent a wide variety of distributional shapes despite limits on assessed fractile parameters. We derive these limits and demonstrate this flexibility.

3 - Streamlining the Global Manufacturing Throughput in T-MEX Trade Corridor- A Case for Distribution
Malini Natarajarathinam, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, malini@entc.tamu.edu, Bimal Nepal, Roberto Murrillo

Globalization and outsourcing is changing the manufacturing map of the globe. This paper presents preliminary results of a study on the opportunities and challenges for developing manufacturing industry along Texas- Mexico trade corridor. It focuses on a case for distribution industry which would like to sell to customers in Mexico. It presents a decision analysis model to help a distributor with its stocking location decisions. Scenarios for both new and established distributors are analyzed.

4 - Space Constrained Optimal Assortment for Products with Conditional Demand Characteristics
Gurcan Bicken, Dir. of Pricing and Product Opt., Autozone, 123 S Front St, Memphis, TN, United States of America, gurcan.bicken@gmail.com, Baofu Ma

Given a finite shelf space in stores for a category, we seek optimal stocking decisions for after market auto parts of different brand names for different model cars. The optimization problem involves the items' conditional sales estimations at the stores based on the stocking scenarios where only one or two of the products of the competing brand names are stocked. Special constraints are applied to the choice products of different brand names according to the competition scenarios.

5 - Business Analytics: Implications for Operations Research Professionals
Matthew Liberatore, John F. Connelly Chair in Management, Villanova University, 800 Lancaster Avenue, Villanova PA 19085, United States of America, matthew.liberatore@villanova.edu, Wenhong Luo

Business analytics and fact-based decision-making are playing increasingly prominent roles in many organizations. This paper discusses the key differences and the relationship between business analytics and traditional OR applications. We also highlight the implications of business analytics for OR professionals and how they can take advantage of this new analytical environment.

■ MD03

C-Room 23A, Upper Level

Analytic Hierarchy Process

Contributed Session

Chair: Myron Hatcher, Professor, Craig School Of Business, California State University, 5245 North Backer Av M/S PB7, Fresno, CA, 93740, United States of America, myronh1225@hotmail.com

1 - Deriving Ratio Scales a Comparison of Stevens and Saaty
William Wedley, Professor Emeritus, Simon Fraser University, Faculty of Business Administration, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, wedley@sfu.ca, Eng Choo

Stevens' magnitude estimation is popular in psychometrics for measuring ratios of qualitative attributes. Saaty's paired comparison process is popular in MCDM for measuring qualitative attributes. Both methods have similar ratio objectives, yet there is very little cross reference in the literature. This study compares Stevens' vector estimation approach to Saaty's matrix calculation approach. It describes the techniques, documents their strengths and weaknesses, and discusses issues.

2 - Analysis and Evaluation of Technological and Operational Alternatives for Heavy Oil Gathering System
Mario Castillo, Titular Professor, Universidad de los Andes, Carrera 1 Este No 19A - 40, Bogota, Colombia, mcastill@uniandes.edu.co, Jose Antonio Padilla, Fredy Nino, Jorge Bustamente, Luis Jose Novoa, Andres Zarate, Juan Carlos Gutierrez

The objective of this project is to develop a general methodology and models for the analysis and evaluation of transportation alternatives for heavy crude oil in two particular fields. Three models were developed, a hydraulic model, a financial model, and a qualitative model. In a first step, these models were applied to a generic unit of analysis, where simulated wells are distributed in a generic manner, and then the results were successfully used in the real fields.

3 - Data Collection Approach in Using Analytic Herarchy Process for Asset Evaluation
Myron Hatcher, Professor, Craig School Of Business, California State University, 5245 North Backer Av M/S PB7, Fresno, CA, 93740, United States of America, myronh1225@hotmail.com

The challenge of obtaining data for asset evaluation specifically for the ANALYTIC HERARCHY PROCESS (AHP) will be reviewed. Subjective data is collected from the decision maker. Objective data about properties are obtained from computerized records and interviews with owner/agent. The problems are correct reflection of the decision maker's values and accurate data about the property. The issues are discussed in reference to the multivariate decision method AHP.

■ MD04

C-Room 23B, Upper Level

Rich Preference Models in Advertising Auctions

Cluster: Auctions

Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, Vancouver, Canada, kevinlb@cs.ubc.ca

1 - Computational Analysis of Perfect-Information Position Auctions
David R.M. Thompson, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, daveth@cs.ubc.ca, Kevin Leyton-Brown

Position auctions were widely used by search engines to sell keyword advertising before being well understood theoretically. This paper augments current theoretical work, using computational equilibrium analysis. By computing Nash equilibria and calculating their expected revenue and social welfare, we can quantitatively answer questions that theoretical methods have not.

2 - Channel Abstraction for Optimized Expressive Advertising Auctions
Tuomas Sandholm, Professor, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sandholm@cs.cmu.edu, William Walsh, Craig Boutilier, David Parkes, Robert Shields, George Nemhauser

Expressiveness and optimization dramatically improve revenue and efficiency in advertising auctions, but direct formulations grow exponentially in the number of bids or attributes. Our approach automatically abstracts supply into channels, based on column and constraint generation. Experiments demonstrate the computational practicality and high solution quality. Theoretical results are also presented.

3 - Simulation-based Game Theoretic Analysis of Keyword Auctions with Low-dimensional Bidding Strategies
Yevgeniy Vorobeychik, University of Pennsylvania, 15 Montgomery Ave, Apt. 6A, Bala Cynwyd, PA, 19004, United States of America, eug.vorobey@gmail.com

We perform a simulation-based analysis of keyword auctions modeled as one-shot Bayesian games. Our results suggest that sincere bidding in GSP auctions is a strikingly poor strategy. Our conclusions from profit analysis agree with Lahaie and Pennock [2007] when values and quality scores are strongly positively correlated. We diverge, however, in showing that auctions that put little weight on quality scores almost universally dominate the pure rank-by-revenue scheme.

■ MD05

C-Room 23C, Upper Level

Panel Discussion: Quality, Statistics and Reliability Issues in Industries

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Moderator: Satish Bukkapatnam, Professsor, Oklahoma State University, School of Industrial Engineering and Man, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu

Russell Barton, Professor, Smeal College of Business, Penn State, 406 Business Building, University Park, PA, 16802, United States of America, rrb2@psu.edu

1 - Industry Application of Statistics & Reliability
Panelist: Jayant Kalagnanam, Senior Manager, IBM T.J. Watson Research Center, Yorktown Hts, NY, 10598, United States of America, jayant@us.ibm.com

I will discuss applications in the Semiconductor Industry and the Oil Industry related to monitoring and reliability and discuss current practices. A major issue with monitoring is model drift. I will discuss some experience with monitoring off-shore oil drilling. Maintenance planning requires reliability analysis coupled with optimization to maximize availability. I will present some approaches that we have developed for simulation based optimization for maintaining oil platforms.

2 - Remote Condition Monitoring and Proactive Service of Medical Imaging Equipment
Panelists: Yibin Zheng, Cris Sievenpiper, Rick Frowein, Kamal Mannar

GE Healthcare is developing technologies to remotely monitor operating parameters of major medical imaging equipment, and in the course, develop correlation of machine data with service patterns. The technologies enable us to automatically and proactively schedule services in many cases, thus eliminate or reduce customer downtime while also improve our service operation's productivity. The presentation describes a general framework and several specific data modeling and data mining approaches.

■ MD06

C-Room 24A, Upper Level

Recent Advances in Computer Experiments I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

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

1 - Building Surrogates with Overcomplete Bases in a Computer Experiment for Bistable Laser Diodes
C F Jeff Wu, Coca Cola Chair in Engineering Statistics, Georgia Institute of Technology, Atlanta, United States of America, jeffwu@isye.gatech.edu, Raybin Chen, Wei C Wang

Motivated by a problem in bistable laser diodes, we construct surrogates iteratively for the complicated surface by using an overcomplete basis set. Computational results show that the proposed algorithms can solve the target problem by (i) capturing the trend of the surface quickly, (ii) guiding the search to regions containing the solutions, and (iii) identifying all solutions efficiently. Performances of the proposed algorithms and two Gaussian process-based algorithms are presented.

2 - Spatial Analysis of Regional Climate Model Ensembles
Stephan Sain, NCAR, P.O. Box 3000, Boulder, CO, 80307, United States of America, ssain@ucar.edu

The North American Regional Climate Change Assessment Program (NARCCAP) seeks to examine uncertainty in regional climate models and projections of climate change through the use of a multi-model ensemble. We are developing statistical methodology to analyze the output in this ensemble based on a Bayesian hierarchical framework incorporating a multivariate spatial model. Case studies will be presented based from NARCCAP focusing on changing precipitation, temperature, and heat waves.

3 - Using Multiple Computer Models/Multiple Data Sources Simultaneously to Infer Calibration Parameters
Brian Williams, Los Alamos National Laboratory, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States of America, brianw@lanl.gov, Max Morris, Thomas Santner

Many computer models are often available to predict the same outcomes. Different physical representations lead to model-specific calibration parameters. In addition, many applications have access to multiple data sources for calibrating uncertain model parameters. This talk describes methodology that uses the outputs from all available computer models and data sources for parameter calibration and ensemble prediction of code output.

4 - Particle Learning Gaussian Processes for Optimization and On-line Classification
Robert Gramacy, Dr, University of Cambridge, Statistical Laboratory, Wilberforce Dr., Cambridge, CB3 0WB, United Kingdom, bobby@statslab.cam.ac.uk

We devise a sequential Monte Carlo method, via particle learning, for sequential updating of the posterior distribution of Gaussian process models for regression, and for classification via latent variables. We exploit the on-line nature of inference to build thrifty sequentially design for optimization via expected improvement and for on-line classification via the predicted entropy.

■ MD07

C-Room 24B, Upper Level

Decision Theoretic Approaches for Quality and Reliability Assessment

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Martin Wortman, Professor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

Co-Chair: Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu

1 - High-stakes Wagering on Reliability
Martin Wortman, Professor, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843, United States of America, wortman@tamu.edu

Reliability modeling often supports "high-stakes wagers" associated with the deployment and operation of technology. In this presentation we will examine reliability driven engineering decisions in the context of a gambling paradigm. In particular, we will explore the ramifications of limited prior information characterizing operational performance or reliability testing on high-consequence engineering decisions.

2 - Reliability Modeling and Technology Assessment for Capital Equipment Acquisition Decisions
Samuel Merriweather, Texas A&M University, Industrial & System Engineering, College Station, TX, 77843, s_merriweather@neo.tamu.edu

Within this presentation we will discuss a risk-based approach to capital equipment budgeting and acquisition supported by reliability/availability life cycle models. We are particularly concerned with technology assessment decisions where capital equipment budgets carry profound financial risk (e.g., small health care facilities) and candidate acquisitions are new technologies having little operational history.

3 - Recurrence-based Local Gaussian Process Method for Nonlinear Non-Stationary System Prediction
Changqing Cheng, Oklahoma State University, Stillwater, OK, 74078, United States of America, changqing.cheng@okstate.edu, Hui Yang, Satish Bukkapatnam

Local Gaussian process (LGP) used for nonlinear process predictions has been extended based considerations of local recurrence properties under highly nonstationary conditions. The method outperforms the global Gaussian process (GGP) in terms of the computational time and prediction accuracy.

4 - Sequential Bayesian Decision Making for End-Point Detection Chemical Mechanical Planarization (CMP)
Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu, Satish Bukkapatnam, Ranga Komanduri, Omer Beyca

In Chemical Mechanical Planarization (CMP) process, accurate and timely decisions for process monitoring and control, such as endpoint detection (EPD), are extremely critical to enable the process to effectively respond to demand variations and disruptions. In this paper, we apply sequential Bayesian analysis and decision theory to find a quantitative relationship that connects the measured sensor signal features with the material removal for endpoint detection of the CMP process.

■ MD08

C-Room 24C, Upper Level

Joint Session DM/HAS: Data Mining and Knowledge Discovery in Healthcare - II

Sponsor: Data Mining & Health Applications
Sponsored Session

Chair: Durai Sundaramoorthi, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu

1 - Development of a Dynamic Treatment Regime for Pain Management
Ching-feng Lin, University of Texas at Arlington, Industrial & Manufacturing Systems Engr., Arlington, TX, United States of America, ching-feng.lin@mavs.uta.edu, Victoria Chen, Robert Gatchel

Pain management is an international health issue. The Eugene McDermott Center for Pain Management at the University of Texas Southwestern Medical Center at Dallas has been studying a two-stage interdisciplinary pain management program that considers a wide variety of treatments. We apply an approximate dynamic programming approach to construct an adaptive treatment strategy for this two-stage program. State transition models were constructed empirically based on data from the two-stage program.

2 - Optimization and Data Mining in Medicine
Vera Tomaino, PhD Student, University Magna Graecia of Catanzaro, 3425 S.W. Second Avenue, Apt 157, Gainesville, FL, 32607, United States of America, vera.tomaino@unicz.it

Mathematical theory of optimization has found many applications in the area of medicine over the last few decades. Several data analysis and decision making problems in medicine can be formulated using optimization and data mining techniques. The significance of the mathematical models is greatly realized in the recent years owing to the growing technological capabilities and the large amounts of data available.

3 - Predictive Analysis (Data Mining) Implementation: Predicting the Risk of an Individual Contracting NP
Louis Duclos-Gosselin, Applied Mathematics (Predictive Analysis, Data Mining) Consultant at Sinapse, Sinapse, 1170 Boul. Lebourgneuf, bureau 320, Quebec, QC, G2K2E3, Canada, louis.gosselin@hotmail.com, Rene Yves Darmon, Benny Rigaux-Bricmont

Starting from earlier health management sciences studies, managers have always tried to find better techniques to effectively manage health operations in order to reduce the costs while increasing patients' wellbeing. This paper shows how managers can use predictive analysis to address such problems. A new predictive analysis technique for solving problems related to the risk of an individual contracting nosocomial pneaumonia (NP) is presented. The technique has been tested on health data.

■ MD09

C-Room 25A, Upper Level

Asymptotic Analysis of Queueing Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Ramandeep Randhawa, University of Sourthern California, Los Angeles, CA, United States of America, Ramandeep.Randhawa@mccombs.utexas.edu

1 - Joint Scheduling of Jobs and PM's in Multiclass Systems

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

In semiconductor wafer fab operations there has been increasing interest in performing "predictive maintenance" in conjunction with job scheduling. In this work, we develop a stylized Markov decision model to represent the joint scheduling process. We give characterizations of the optimal policy in both the single and multiclass cases and calculate optimal policies. In some cases, the optimal policies suggest counterintuitive decisions.

2 - Optimal Buffer Size and Dynamic Rate Control for a Queueing Network with Reneging in Heavy Traffic

Arka Ghosh, Iowa State University, 3216 Snedecor Hall, Department of Statistics, Iowa State University, Ames, IA, 50011-1210, United States of America, apghosh@iastate.edu, Ananda Weerasinghe

We address a control problem associated with a single server Markovian queue with customer abandonment with an infinite horizon discounted cost under heavy traffic. The controls are: buffer size for the queue and a state-dependent service rate. By solving the limiting diffusion control problem explicitly, we propose a suitable control for queueing network and prove its asymptotic optimality. This optimal solution also identifies the parameter regimes where the infinite buffer size is optimal.

3 - Accuracy of Fluid Models for Capacity Planning in Queueing Systems

Ramandeep Randhawa, University of Sourthern California, Los Angeles, CA, United States of America, Ramandeep.Randhawa@mccombs.utexas.edu, Achal Bassamboo

We study the optimal capacity sizing problem for an M/M/N+G system. We use fluid models to characterize near-optimal prescriptions. These prescriptions depend intricately on the entire abandonment distribution and can lead to an operating regime with traffic intensity greater than 1. We demonstrate that in this case, the prescription is optimal up to O(1). That is, as the customer arrival rate increases, the optimality gap does not grow.

■ MD10

C-Room 25B, Upper Level

Approximate Dynamic Programming and Large-Scale Stochastic Optimization

Sponsor: Applied Probability
Sponsored Session

Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

Co-Chair: Vivek Farias, Assistant Professor, MIT Sloan School, E53-317, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, vivekf@mit.edu

1 - Approximate Dynamic Programming via a Smoothed Linear Program

Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Vivek Farias, Vijay Desai

We present a novel algorithm for approximate dynamic programming (ADP) which we call smoothed approximate linear programming (SALP). SALP is a relaxation of the standard LP approach to ADP that offers several advantages: We demonstrate superior theoretical bounds the resulting approximation quality. Experiments with SALP on a challenging problem (the game of Tetris) show that it outperforms a variety of ADP algorithms (LP, TD-learning and policy gradient methods) by a significant margin.

2 - Markov Decision Processes with CVAR Constraints

Vivek Borkar, Professor, Tata Institute of Fundamental Research, Homi Bhabha Road, Mumbai, 400005, India, borkar@tifr.res.in, Rahul Jain

We consider the problem of controlling a Markov decision process where an associated conditional value-at-risk (CVAR) is required to be bounded by a prescribed constant. A dynamic programming based formulation of the problem suggests a recursive scheme for computing the optimal solution.

3 - Reservoir Management Based on Approximate Dynamic Programming

Zheng Wen, 123 Blackwelder Ct. Apt. 109, Stanford, 94305-7519, United States of America, zhengwen@stanford.edu, Khalid Aziz, Louis Durlofsky, Benjamin Van Roy

Petroleum reservoir management is in general a large-scale, nonlinear dynamic optimization problem. In this project, we propose computational methods to solve this problem based on Approximate Dynamic Programming. Specifically, we generate features of the approximate value function based on Proper Orthogonal Decomposition and compute the weights of features based on TD-Learning and Approximate LP. Some simulation results based on this algorithm are also demonstrated.

4 - Managing Customer Goodwill with Approximate Dynamic Programming

Dan Adelman, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, United States of America, dan.adelman@chicagobooth.edu, Adam Mersereau

We develop an approximate dynamic programming approach to the problem faced by a supplier deciding how to dynamically allocate limited capacity among a portfolio of customers who remember the fill rates provided to them in the past when making ordering decisions.

■ MD11

C-Room 25C, Upper Level

Operations Research and Decision Sciences Applications for Terrorism and Border Security

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Henry H Willis, Policy Researcher, RAND Corporation, 4570 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, hwillis@rand.org

1 - Community Response to Crisis: Modeling the Social Amplification of Risk

William Burns, Research Scientist, Decision Research, 511 Hillock Place, Encinitas, CA, 92024, United States of America, bburns@csusm.edu

Paper investigates how public response to a disaster translates into potentially large economic impacts. A taxonomy is proposed that looks at risk perception not only in terms of an event's characteristics but also in terms of context, seeks to capture risk-related behavior over time and in response to other critical factors and suggests that we not only describe risk response but do so in a way that informs risk management decisions. Survey data and output from the systems model presented.

2 - Bandits and Border Security

Joel Predd, Researcher, RAND Corporation, 4570 Fifth Avenue, Pittsburgh, PA, 15208, United States of America, jpredd@rand.org, Henry H Willis

DHS has the responsibility to protect and control U.S. borders against terrorist threats, criminal endeavors, illegal immigration and contraband. Unfortunately, resource constraints make it infeasible to "see and be" everywhere at once, and necessitate allocating limited border assets to the places where and at the times when they may be most effective. The talk describes research to model tactical, resource-constrained border allocation decisions as multi-armed bandit problems.

3 - Value Focused Thinking for Evaluating Alternative Counter-terrorism Policies

Richard John, Associate Professor, University of Southern California, CREATE & Dept of Psychology MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu, Heather Rosoff

Decisions related to counter-terrorism policy typically involve multiple and conflicting objectives. Both public and private decision makers must devise policies to counter threats from terrorist organizations that reflect concerns such as health and safety, rights to privacy, economic growth, and direct costs. We demonstrate the use of value focused thinking and multi-attribute utility modeling to aid in the formation and evaluation of competing policy options.

4 - A Decision Framework for Assessing Border Security Risks and Mitigation

Larry Head, Associate Professor, University of Arizona, University of Arizona, Tucson, AZ, 85721, United States of America, larry@sie.arizona.edu, Michael Leeming, Jian Liu, Ferenc Szidarovszky, Cheng Zhu

Risk at national borders is a complex phenomenon that includes a variety of events and activities that extend from concerns for criminal networks, illegal immigration, environmental, and health risks. Border risks activities are

composed of sequences of events that involve a variety of actors, their communications, facilities, and interaction with security systems. This research focuses on the structure of a decision framework for assessing risks through activity identification and prediction.

■ MD12

C-Room 26A, Upper Level

Hidden Linearity, Hidden Convexity, and Hidden Separability in General Nonlinear Programming — Uncovered, Reformulated, and then Transformed for Both Qualitative and Quantitative Exploitation I

Sponsor: Computing Society
Sponsored Session

Chair: Elmor Peterson, Systems Science Consulting, 3717 Williamsborough Court, Raleigh, United States of America, elpeterson@alumni.cmu.edu

1 - An Introductory Tutorial
Elmor Peterson, Systems Science Consulting, United States of America, elmor.peterson@gmail.com

Novel explanations (using only elementary calculus and linear algebra) introduce the signature qualitative and quantitative natures that characterize both 'geometric programming' (the original prototype methodology for nonlinear-algebraic optimization) and its various generalizations (including general nonlinear optimization/equilibration) — each of which has evolved over the past 49 years, beginning with the seminal work of Zener and Duffin on unconstrained "signomial" optimization.

■ MD13

C-Room 26B, Upper Level

COIN-OR Software Solutions for Real Applications

Sponsor: Computing Society
Sponsored Session

Chair: Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

1 - Optimization and Control of Clean Technologies with COIN-OR
Timothy Middelkoop, Assistant Engineer, University of Florida, 303 Weil Hall, Gainesville, United States of America, t.middelkoop@ufl.edu, Elif Akcali, Cristiàn Càrdenas

In this paper we show how COIN-OR provides the software solutions required to solve real world energy optimization problems. Energy and climate pressures in today's society have created a demand to use energy more efficiently and intelligently. In order to solve this problem there is a need to integrate advanced energy optimization with modern control technologies. The paper details the use and integration of the COIN-OR project tools in such an energy control framework.

2 - Transportation System Design Using COIN-OR
Saravanan Kuppusamy, PhD Student, Department of Quantitative Analysis and Operations Management,College of Business,University of Cincinnati, 2925 Campus Green Drive, P.O. Box 210130, Cincinnati, OH, 45221-0130, United States of America, kuppussn@email.uc.edu, Kipp Martin, Michael Magazine

The Bearcat Transportation System of the University of Cincinnati is modeled and solved as a multiple vehicle routing problem. The Student population and travel time data coupled with client driven constraints are used to design the transportation system. The COIN-OR solver CBC is used in a GAMS environment to solve the problem. Results indicate the solutions are effective and implementable.

3 - Scheduling Doctors to Clinical and Surgical Time Slots: A Column Generation Approach
Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu, Cary Wise, Craig Froehle, Michael Magazine

We consider the problem of scheduling doctors to clinical and surgical time slots over a five-week horizon. This leads to an integer program with millions of variables. We discuss the solution of this problem using column generation with COIN-OR branch cut and price (BCP).

■ MD14

C-Room 27A, Upper Level

Software for OR/MS IV

Sponsor: Computing Society
Sponsored Session

Chair: Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

1 - New Gurobi Solver Version 2.0
Robert Bixby, Gurobi Optimization Inc., 3733-1 Westheimer Road, Houston, TX, 77027, United States of America, bixby@gurobi.com

Some of the new features of Gurobi Version 2.0 will be discussed.

2 - New Stochastic Programming Enhancements for the MPL Modeling Language
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

Formulating stochastic models in a modeling language and deploying it to end-users has long been a challenge in practice. In this presentation we will review how both scenario-based and independent variables stochastic models can be effectively formulated in a modeling language, such as MPL. Several formulations of SP models will be demonstrated.

3 - Experimenting with Near-Optimal Integer Programming Formulations for Discrete Optimization Problems
Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

When a mixed-integer program can't be solved to optimality, sometimes much better results can be achieved by "cheating" a bit on its formulation: modifying the search space in ways not guaranteed to preserve the solution's optimality but highly unlikely to make a difference given the model and data of interest. A series of case studies illustrate that although a few general principles can offer guidance, much trial and error is involved, for which purpose a flexible modeling language is ideal.

4 - Handling Second Order Stochastic Dominance through Cutting Plane Representations of CVaR
Gautam Mitra, CARISMA, Brunel University, West London, United Kingdom, gautam.mitra@brunel.ac.uk, Csaba Fabian, Diana Roman, Viktar Zviarovich

Second order stochastic dominance (SSD) is used as a choice criterion in portfolio models due to its relation to risk-averse economic behaviour; the computational difficulty of solving SSD-based models is also well known. An SSD model is formulated as a multi-objective CVaR minimization problem which is then reformulated using a cutting plane representation of CVaR . This approach dramatically increases the execution speed and makes the model solvable even for very large number of scenarios.

■ MD15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Responsive Learning Technologies, Inc. - Online Games to Teach Operations and Supply Chain Management
Sam Wood, President, Responsive Learning Technologies, Inc., 4546 El Camino Real, Suite 243, Los Altos, CA, 94022, United States of America, wood@responsive.net

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

2 - LINKS-simulations.com - Best-Practice Teaching With a Sophisticated Supply Chain Management Simulation

Randall G. Chapman, LINKS-simulations.com, 320 Forest Haven Drive, Winter Garden, FL, 34787, United States of America, chapman@chapmanrg.com

Teaching with a sophisticated supply chain management simulation is a daunting instructional endeavor, especially with a full parsing of the adjective 'sophisticated.' As used here, 'sophisticated' includes the implicit descriptors 'large-scale,' 'competitive,' 'web-based' and 'team-based.' Drawing on simulation design experience, extensive personal teaching experience in traditional classroom-based and distance-learning modes, and 'train-the-trainer' coaching experience with 100+ instructors and their 25,000+ students with the LINKS simulations over the last ten years, the LINKS author provides and summarizes best-practice insights into the design and execution of successful simulation-based operations management and supply chain management courses. A guided-tour/demo of the LINKS website and associated user resources is provided.

■ MD16

C-Room 28A, Upper Level

Cognitive Neuroscience in Management Sciences

Sponsor: Information Systems
Sponsored Session

Chair: Angelika Dimoka, Assistant Professor - Director, Center for Neural Decision Making, Temple University, 510 Alter Hall, 1801 Liacouras Walk, Philadelphia, PA, 19122, United States of America, angelika@temple.edu

1 - Effective Health Marketing: Understanding the Underlying "Brain" Mechanisms of Self-Positivity Bias

Yanliu Huang, Assistant Professor of Marketing, Chinese University of Hong Kong, Shatin, NT, Hong Kong, China, yanliuh@wharton.upenn.edu, Angelika Dimoka

In three studies, the current research explores the brain mechanisms of self positivity bias ,Ä' a robust finding that consumers' self-perceptions are in general self-enhancing and they tend to estimate the likelihood of something negative happening as lower for themselves than for others. Understanding the nature of self-positivity bias and coming up with corresponding marketing strategies to overcome these biases have important implications in the field of health marketing.

2 - To Trust or Not; New Insights From Functional Neuroimaging Studies

Angelika Dimoka, Assistant Professor - Director, Center for Neural Decision Making, Temple University, 510 Alter Hall, 1801 Liacouras Walk, Philadelphia, PA, 19122, United States of America, angelika@temple.edu

This study employs functional neuroimaging (fMRI) tools to complement psychometric measures of trust and distrust by observing the location, timing, and level of brain activity that underlies trust and distrust and their underlying dimensions. The neural correlates of trust and distrust are identified when subjects interact with four experimentally manipulated seller profiles that differ on trust and distrust (high and low).

3 - The Dark Side of Product Attachment: Reactivity of Addicted Users to Ad Cues

Dante Pirouz, Doctoral Candidate, University of California, Irvine, P.O. Box 10653, Newport Beach, CA, 92617, United States of America, dpirouz04@exchange.uci.edu

Advertising is a ubiquitous and pervasive environmental cue. On average, the typical consumer is exposed to three thousand ads per day. For the most part, consumers are able to filter which ads they attend to. For addicted consumers, however, environmental cues may elicit a unique type of response affecting decision making and risk behavior. Based on cue reactivity theory, this research investigates the effect of advertising on addicted users using fMRI.

■ MD17

C-Room 28B, Upper Level

Matching Operations and Marketing in Internet Retailing

Sponsor: e-Business
Sponsored Session

Chair: Ken Boyer, Professor, Ohio State University, Fisher College of Business, Columbus, OH, United States of America, boyer_9@fisher.osu.edu

1 - Is Tom Cruise Threatened? Empirical Examination the Long Tail of Electronic Commerce

Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Tom Tan

First popular press and then academic literature suggested that new economics of product distribution on the Internet are such that, over time, consumers will increasingly shift towards purchasing niche products and away from hit products. In this study we use a unique data set from an on-line movie rental company to study the dynamics of movie consumption on the Internet over time in an attempt to shed a new light on the causes and consequences of the Long Tail effect.

2 - Service Quality and Customer Loyalty for Pure-Play Internet Retailers

M. Johnny Rungtusanatham, Carlson School of Management, University of Minnesota, Minneapolis, MN, 55455, United States of America, rung0002@umn.edu

The relationship between service quality and customer loyalty is presumed to exist, be positive, and be linear. Anecdotal and empirical evidence tends to support this presumption. This research challenges the presumption of linearity in the context of pure-play internet retailing. We hypothesize and find support that the relationship is actually piece-wise linear, with a zone of indifference.

3 - Examining the Marketing Benefit of Real Options in an Internet Retailing Context

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

This paper empirically examines the impact of real options used to market service operations within an online retailing context. We estimate a regression function based on several real option factors, and discuss its implications.

4 - Using Customer Ratings to Predict Future Purchases

Ken Boyer, Professor, Ohio State University, Fisher College of Business, Columbus, OH, United States of America, boyer_9@fisher.osu.edu, Christian Randall

We employ a database of 15,000 customer ratings of shoes and the shoe buying experience to predict followup purchases in a longitudinal manner. The customer ratings are written comments which have been re-coded to assess operational aspects of the customer experience, including fit, quality, delivery and service. This data is matched with a separate database of purchases by those customers over the 6 following month timespan. All data furnished by a major online retailer of shoes.

■ MD18

C-Room 28C, Upper Level

Combinatorial Optimization Algorithms

Sponsor: Computing Society
Sponsored Session

Chair: Dorit Hochbaum, Professor, UC Berkeley, Dept of IEOR, Etcheverry Hall, Berkeley, CA, 94720, United States of America, hochbaum@ieor.berkeley.edu

1 - Polynomial Time Algorithms for Clustering and Image Segmentation Problems

Dorit Hochbaum, Professor, UC Berkeley, Dept of IEOR, Etcheverry Hall, Berkeley, CA, 94720, United States of America, hochbaum@ieor.berkeley.edu

We consider here clustering problems, which typical entail two or more objectives, and are often employed in the context of image segmentation. We show here that two problem, called in the literature "normalized cut" and another called "ratio cutswhich were both thought to be hard, are in fact solvable in polynomial time, and with very efficient cut-based algorithms. We also demonstrate efficient approaches to other clustering problems used in image segmentation.

2 - Fast Approximate Subset Sums

James Orlin, Professor, MIT, E53-363, Cambridge, Ma, 02139, United States of America, jorlin@MIT.EDU

Let S = {w_1, ,Ä¶, w_n} be a set of weights and let b be an integer. Given relative error q, we give a simple algorithm (an FPTAS) that produces a subset of S whose sum is in [b(1-q), b], or else the sum is the largest possible sum that is less than b. The running time is O((n + (1/q))^2)(log 1/q)). We also describe an even faster algorithm for approximate subset sum that relies on Fast Fourier Transforms (FFT), improving upon the previous best running time by nearly a factor of sqrt(1/q).

3 - A New Approximation Algorithm for the Asymmetric Traveling Salesman Problem

Amin Saberi, Professor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

Despite intensive effort, the O(\log n) approximation ratio established by Frieze et al. for the asymmetric traveling salesman problem has not been improved. In this talk, I will discuss a new approach that is based on choosing a ``thin" spanning tree from the solution of the linear relaxation of this problem.

■ MD19

C-Room 28D, Upper Level

Urban Freight Transportation and Service Operations

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Felipe Sandoval, University of Washington, 135 More Hall, Seattle, WA, United States of America, felipe7@u.washington.edu

1 - Retailer Backhauling as a Policy to Cope with Urban Access Restriction Rules

Rene De Koster, Professor, Rotterdam School of Management, Erasmus University, T10-38,Burgemeester Oudlaan 50, Rotterdam, Netherlands, rkoster@rsm.nl, Hans Quak

Urban time-window regulations lead to low vehicle utilizations in retail distribution. We study possibilities for retailers to combine deliveries to the stores with backhauling, to improve vehicle utilization. We examine four retail cases under different time-window scenarios, and optimize vehicles routes. Backhauling under time-window restrictions appears to lead to much higher utilizations, with only a little increase in total travel distance.

2 - Matching Line Haul Truck Capacity to Customer Demand Using Dynamic Transfer Points

Agha Iqbal Ali, Chair, Finance and Operations Management, Isenberg School of Management, University of Masachusetts, 121 Presidents Drive, Amherst, MA, 01003, United States of America, aiali@som.umass.edu, Milad Ebtehaj

We study logistics scenarios in which the first echelon is a line haul of product to a dynamically determined transfer point from which second-echelon-distribution to demand points can be either direct, split, or joint. Three determinants that affect problem complexity are distribution configuration, demand patterns, and truck capacity. We report the results of a computational study that reveals the impact of these determinants on overall system wide capacity utilization and mileage.

3 - Optimal Workforce Deployment and Shift Scheduling for Snow and Ice Removal

Elif Tokar-Erdemir, University of Minnesota, 111 Church St., Minneapolis, MN, 55455, eerdemir@me.umn.edu, Diwakar Gupta

Because the timing, severity and duration of snowstorms are random, workforce deployment policies have a significant impact on state agencies' budgets. We use data from Saint Louis County in Minnesota to formulate the problem of deciding when to call/hold-back crew, which road segments to assign to each operator, and knitting each operator's assignment into passes that can be plowed/sanded with a single payload. We also study the impact of different types of uncertainty on deployment strategies.

■ MD20

C-Room 28E, Upper Level

Vehicle Routing and Variants

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Faramroze Engineer, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, fenginee@isye.gatech.edu

1 - ELOCONS: Efficient Low Cost Route Construction Heuristic for the VRPTW in SME's Field

Alejandro Garcia del Valle, Professor, University of A Coruna, Polytechnic School, Campus de Esteiro, Ferrol, NA, 15403, Spain, agvalle@udc.es, Adolfo Lamas Rodriguez, Javier Faulin, Arturo Nieto, Diego Crespo Pereira, David del Rio Vilas

ELOCONS is a route construction heuristic for the VRPTW. In the field of the small and medium enterprises (SME's), efficient solutions with low cost implementation and resource assignments are required. ELOCONS is based on logical decisions, obtaining very good experimental results on Solomon's 100 customers instances, showing that ELOCONS is highly efficient and robust, producing very good solutions in short time under a computational realistic environment.

2 - An Advanced Integer Programming Based Hybrid Heuristic for Generalized VRP-like Problems

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Placid Ferreira, Anupam Seth

Production planning for PCB assembly has defied standard OR approaches due to the size and complexity of the problems. We examine popular collect-and-place machines and model the problem as a generalized vehicle routing problem. We present a hybrid heuristic consisting of an initial constructive phase with a worst-case guarantee and an improvement phase based on integer-linear programming. Theoretical and computational results are presented to demonstrate the effectiveness of the technique.

3 - Extension of the Sweep Algorithm for Vehicle Routing Problems

Byung-In Kim, Associate Professor, Industrial & Management Engineering, POSTECH (Pohang University of Science & Technology), San 31, Hyoja-Dong, Pohang, Kyungbuk, Korea, Republic of, bkim@postech.ac.kr, Yeowoon Jun, Byungsoo Na

The sweep algorithm has been widely used for the vehicle routing problem and its variants since it was published in 1974. It clusters a group of customer stops into a route according to the polar angle for the stops with the depot. In this talk, we point out a limitation of the sweep algorithm and propose some extensions of the algorithm. The effectiveness of the extensions will be demonstrated with the computational results on the benchmark problems of vehicle routing problem.

4 - A Branch-price-and-cut Algorithm for a Maritime Inventory Routing Problem

Faramroze Engineer, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, fenginee@isye.gatech.edu, George Nemhauser, Jin-Hwa Song, Kevin Furman, Martin Savelsbergh

Our time indexed model does away with assumptions regarding constant capacities, production, and demand rates. We outline a new DP algorithm for the resulting mixed integer pricing problem. We also add variants of capacity cuts known for vehicle routing, and cuts that specifically target fractional solutions brought about by vessels competing for capacity and inventory. We can solve practically sized problems to optimality and prove reasonable bounds for larger problems.

■ MD21

C-Room 30B, Upper Level

Methods and Models for Road Pricing I

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

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

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

1 - Consistent Anticipatory Congestion Pricing: An Iterative Algorithm for Online Application

Hani Mahmassani, W. A. Patterson Distinguished Chair in Transportation and Director, Northwestern University, Transportation Center, Evanston, IL, 60208, United States of America, masmah@northwestern.edu, Jing Dong

This study presents a consistent anticipatory pricing problem that regulates dynamic congestion prices based on forecast traffic, e.g. for value pricing applications. To achieve consistency between predicted and experienced traffic conditions, we present a procedure that iterates between toll-setting (using predicted traffic conditions) and performance-evaluation (considering user response to tolls). Simulation results illustrate the effectiveness of this dynamic pricing algorithm.

2 - Congestion Option

Tao Yao, Assistant Professor, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Mike Mingcheng Wei, Yafeng Yin, Terry Friesz

We introduce the idea of a congestion call option to value commuting along a given path for a given departure time selected by road commuters who are modeled as non-cooperative agents competing for limited roadway capacity. We show that congestion options have the potential to lower the total society costs of congestion.

3 - Pareto-improving Dynamic Congestion Pricing with Heterogenous Commuters

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

This paper examines dynamic congestion pricing in a simple road network with parallel routes using bottleneck model. User heterogeneity is incorporated by considering different value of time and schedule delay penalties across the population. A Pareto-improving toll scheme is proposed, which aims to improve the social welfare while ensuring that no one is worse off in favor of others' gain.

4 - Congestion Pricing in Stochastic Networks with Users' Perception

Yingyan Lou, Assistant Professor, Department of Civil, Construction, and Environmental Engineering, The University of Alabama, Bevill Hall, The University of Alabama, Tuscaloosa, AL, 35487, United States of America, ylou@eng.ua.edu, Lihui Zhang, Yafeng Yin, Siriphong Lawphonganich

This paper applies the cumulative prospect theory to model users' spontaneous response to pricing signals in an uncertain traffic environment and then examines its impact on the efficiency of congestion pricing. Considering users' subjective perception of travel time distributions and value of travel choices, an optimization model is formulated to design pricing strategies for stochastic traffic networks.

■ MD22

C-Room 30C, Upper Level

Panel Discussion: The Academic Job Search

Cluster: Job Placement Service
Invited Session

Chair: Talisa Murray, Systems Analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu

1 - Academic Job Search

Moderator: Talisa Murray, Systems Analyst, JHU/APL, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Talisa.Murray@jhuapl.edu, Panelists: Feryal Erhun, Mark Ferguson, Ted Ralphs

The panel will lead an informal discussion concerning the academic interview process, the appropriate steps to take during the job search, and the challenges that may be faced along the way. Time will be provided for questions and answers.

■ MD23

C-Room 30D, Upper Level

DIME/PMESII Pt 5

Sponsor: Military Applications Society
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Wicked Problems and Comprehensive Thinking in Irregular Warfare

Mark Clemente, Senior Effects Based Analyst, The Boeing Company, 1215 S. Clark St, Ste 346 MC 793C-G029, Arlington, VA, 22202-4398, United States of America, Mark.N.Clemente@boeing.com, Ed Smith

Irregular Warfare requires close coordination between disparate actors that do not normally work together - military diplomatic, political, social, and economic and is fundamentally about wicked problems with no definitive solution. This paper combines James Grier Miller's Living Systems theory with complexity and decision making theory to offer a framework for understanding how to cope with wicked problems and for identifying analytic tools that might help bound complex environments.

2 - Cultural Geography in Stability Operations Modeling

Leroy (Jack) Jackson, Senior Analyst & Deputy Director, US Army TRADOC Aalysis Center, P.O. Box 8695, Monterey, CA, 93933, United States of America, lajackso@nps.edu

This presentation will describe modeling the civilian population in order to understand the response of the population to insurgent, government and stability force actions. The model represents a conflict ecosystem as described by Dr. David J. Kilcullen in his Counterinsurgency in Iraq: Theory and Practice, 2007 report. Models and algorithms in the agent-based model are implementations of selected social theories.

3 - Today's Russia - A Peer Competitor?

Michael Horn, Senior Defense Analyst, The Boeing Company, 1215 S Clark Ste, Suite 300, MC 793C-G029, Arlington, VA, 22202, United States of America, michael.r.horn@boeing.com

This study examines when Russia could become a peer challenger to the US. To define peer challenger, we use two DoD constructs: the instruments of national power (Diplomatic, Informational, Military, Economic, or "DIME") and the challenges quadrant (Irregular, Catastrophic, Disruptive, Traditional). We identify how Russia could challenge US interests over time in each quadrant using every element of DIME and determine if Russia fulfills the criteria to be considered a peer challenger.

■ MD24

C-Room 30E, Upper Level

Human Network Analysis: Social Networks in Conflicts

Sponsor: Military Applications Society
Sponsored Session

Chair: Richard F Deckro, Professor of Operations Research, Air Force Institute of Technology, AFIT/ENS; Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, richard.deckro@afit.edu

1 - Beyond Clustering: A Likelihood Approach to Detecting Community Structure

Greg Michaelson, University of Alabama, 186 7th St SW, Vernon, AL, 35592, United States of America, gvmichaelson@crimson.ua.edu, Marcus Perry

The graph partitioning problem has been around for centuries, but has, in recent years, has become the topic of intense research in diverse fields, from computer science to physics to the social sciences. Most efforts have focused on identifying, dense, yet sparsely interconnected clusters. We suggest that this definition of community structure is unacceptably limiting, and propose a likelihood framework for distinguishing significant community structure from structures due to randomness.

2 - A Probabilistic Programming Approach in the the Analysis of Social Networks

Ed Pohl, University of Arkansas, Department of Industrial Engineering, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, epohl@uark.edu, Mauricio Guzman

This study investigates the impact that uncertainty in the relationships among actors or members in a network has on the analysis of the social network.

Probabilistic programming is used to model the effects of uncertainty in the network. The models with uncertainty show a threshold for which the results are robust and consistent with the deterministic case.

3 - A New Random Graph Generation Algorithm Designed for Social Network Analysis

James Morris, Department of the Air Force, 4180 Watson Way, Wright-Patterson AFB, OH, 45433, United States of America, James.Morris@WPAFB.AF.MIL, Jerome O'Neal, Richard F Deckro

Available random graph generation algorithms suffer from tendencies to generate disconnected graphs and to connect hubs directly. We present a new algorithm, the Prescribed Node Degree, Connected Graph (PNDCG) Algorithm, designed to generate weakly connected social networks with extensions to impact clustering coefficients and assortative mixing within the network. Empirical test results demonstrate the capability of the PNDCG Algorithm to produce networks with the desired properties.

■ MD25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Propagation of Flight Delays and Passenger Impacts II

Sponsor: Aviation Applications & Transportation Science and Logistics

Sponsored Session

Chair: Vikrant Vaze, Massachusetts Institute of Technology, 77, Massachusetts Avenue, Room No. 1-245, Cambridge, MA, 02139, United States of America, vikrantv@mit.edu

1 - Re-Booking Disrupted Airline Passengers While Uncertainty Still Remains

Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu, Lindsey Selegue, Divakar Viswanath

When a flight is extensively delayed (e.g. due to a mechanical problem), one alternative is to re-book passengers onto other itineraries. We investigate the impact of uncertainty (both on the repair time for the originally delayed flight and also potential future disruptions to other flights) on the passenger re-booking decision.

2 - Robust Airline Scheduling: Insights From an Empirical Analysis

Virot Chiraphadhanakul, MIT, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, virot@mit.edu, Cynthia Barnhart

We present some insights gained from studying several robust scheduling models including flight re-timing, aircraft re-routing, and block time adjusting, and their variants. We compare the performance of each model based on passenger-centric metrics and delay propagation and reveal trade-offs among them. The computational results are obtained from both actual historical data from an airline and output from simulation which takes into account potential recovery during the day of operation.

3 - Spatial and Temporal Examination of Propagated Flight Delays

Andrew Churchill, Graduate Research Assistant, University of Maryland, Dept of Civil Engineering, 1173 Martin Hall, College Park, MD, 20742, United States of America, churchil@umd.edu, David Lovell

Because aircraft typically operate several flights scheduled in close sequence to one another on a single day, propagation of delays between flights can have a serious impact on operations. We use a large database of historical records of individual flight records to identify where and when original delays occur. Delay for each flight is then categorized as either original or propagated. The spatial and temporal relationships between the original and subsequent propagated delays are examined.

4 - Efficient Utilization of National Air Transportation System Capacity

Vikrant Vaze, Massachusetts Institute of Technology, 77, Massachusetts Avenue, Room No. 1-245, Cambridge, MA, 02139, United States of America, vikrantv@mit.edu, Cynthia Barnhart

Frequency-based competition among US domestic airlines has led to decreasing aircraft sizes, causing airports to operate at levels close to capacity. We formulate and solve the problem of efficient utilization of available capacity as a mixed integer linear program to obtain a lower bound on system delays. Next we assess the effects of the control mechanisms and incentives on various stakeholders including passengers and airlines.

■ MD26

C-Room 31B, Upper Level

Joint Session AAS/TSL: Airport Collaborative Decision Making in the US

Sponsor: Aviation Applications & Transportation Science and Logistics

Sponsored Session

Chair: Yu ZhangAssistant Professor, University of South Florida, 4202 E. Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, yuzhang@eng.usf.edu

1 - Modeling and Control of Airport Taxi Processes for Emissions Reduction

Ioannis Simaiakis, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 35-217, Cambridge, MA, 02139, United States of America, ioa_sim@mit.edu, Hamsa Balakrishnan

Aircraft taxiing for takeoff contribute significantly to the fuel burn and emissions at airports. This talk investigates the possibility of reducing fuel burn and emissions from surface operations through a reduction of the-out taxi times of aircraft. We propose a model that treats aircraft taxi-out processes as a series of queues, and demonstrate that the model can be used to predict taxi-out times. We also illustrate how taxi times can be reduced through improved queue management strategies.

2 - Challenges Facing Realization of Trajectory-based Surface Operations at Major Airports

Victor Cheng, Dr., Optimal Synthesis Inc., 95 First Street, Suite 240, Los Altos, CA, 94022, United States of America, vcheng@optisyn.com

Airport congestion is a major problem of the National Airspace System, especially at major airports with complex layouts. Trajectory-Based Surface Operations (TBSO) is a concept that enables more efficient aircraft movement. Technical challenges for TBSO include development of automation systems for tower controllers to plan the 4D-trajectory operations, and flight-deck automation to execute the 4D-trajectory clearances with the expected level of precision.

3 - Collaborative Departure Queue Management Algorithm Design and Testing

Christopher Brinton, President/Principal Analyst, Mosaic ATM Inc., 801 Sycolin Rd., Suite 212, Leesburg, VA, 20175, United States of America, brinton@mosaicatm.com, Stephen Atkins

During periods of high demand, long queues of aircraft form at the departure runways, causing unnecessary fuel burn and substantial environmental impact. However, to reserve a departure slot, each flight must push-back and physically occupy a spot in the line. The CDQM concept meters departures while providing flexibility to flight operators. This paper addresses the CDQM algorithm, which allocates departure capacity amongst flight operators, and results of field testing of the CDQM concept.

■ MD27

C-Room 31C, Upper Level

Supply Chain Simulation II

Sponsor: INFORMS Simulation

Sponsored Session

Chair: Scott Grasman, Missouri S&T, Rolla, MO, 65409, United States of America, grasmans@mst.edu

1 - A Simulation-based Methodology for VRP with Stochastic Demands

Javier Faulin, Associate Professor, Public University of Navarre, Dept of Statistics and OR, Campus Arrosadia, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es, Angel Juan, Scott Grasman

The SR-GCWS-CS is a hybrid algorithm developed by the authors to solve the Capacitated Vehicle Routing Problem (CVRP). This algorithm combines the Clarke and Wright Heuristic with Monte Carlo Simulation and splitting techniques to generate a set of alternative pseudo-optimal solutions for the CVRP. As an evolution of previous work, we present here a variant of this algorithm that can be used to solve Vehicle Routing Problems with Stochastic Demands (VRPSD).

2 - Quantification of the BWE: The Case of Small-sized Companies
Martha Centeno, Associate Professor, Florida International University, 10555 W. Flagler St, EC 3145 - ISE Department, Miami, FL, 33174, United States of America, centeno@fiu.edu, Jaime Perez

We have analyzed the interaction between demand management strategies and forecast methods on BWE, using a simulation model. Five factors were considered: demand management strategy, forecast method, Lead Time, seasonality, and ordering policy. Response variables were BWE index and total cost. Results indicate that no demand management strategy dominates under all conditions. Collaborative demand management seems best for low seasonality regardless of the forecasting method and lead time nature.

3 - Simulation-based Optimization of AGV Capacity
Abhijit Gosavi, Missouri S & T, 219 Enginnering Management, Rolla, United States of America, gosavia@mst.edu, Scott Grasman

Optimization of AGV capacity has not been studied in the literature extensively. Most of the existing models are analytical and make restrictive assumptions about the system. We present a simulation-based optimization model that can be used to optimize the capacity of a single-vehicle stochastic system. We obtain encouraging numerical results.

■ MD28

H-Room 500, Fifth Floor

New Directions in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. Geroge Street, Toronto, ON, M5S3E6, Canada, ming.hu@rotman.utoronto.ca

1 - Price Dynamics under Limited Information
Omar Besbes, Columbia University, Graduate School of Business, 3022 Broadway, Uris Hall, New York, 10027, United States of America, ob2105@columbia.edu, Assaf Zeevi

We consider a single product pricing problem in an uncertain demand environment and analyze price dynamics in the presence of three key elements: recalibration, demand model mis-specification and competition. We illustrate how price instability can arise as a result of the interplay of at least two of these elements.

2 - Contracting with Forecast Updates and Asymmetric Information
Ozge Sahin, Assistant Professor, University of Michigan, Stephen M Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, ozge@bus.umich.edu

The goal of the research is to investigate the value of forecasting in a decentralized supply chain. We consider a two period, single retailer and single supplier problem. The retailer's type and subtype after the forecast update are her private information. We compare and contrast three contract types for a Bayesian updating supplier and retailer.

3 - Designing Post-Sales Services for a Broader Market
Julie Ward, Hewlett-Packard Labs, 1501 Page Mill Rd, Palo Alto, CA, 94304, United States of America, jward@hp.com, Jose Luis Beltran, Enis Kayis, Filippo Balestrieri, Guillermo Gallego, Ming Hu, Ruxian Wang, Shailendra Jain

We present several new service concepts, such as monthly billed warranties and warranty options. These new services have more attractive cash-flow characteristics than traditional warranties, and in some cases may provide more flexibility to respond to technological innovations in the marketplace. Further, these services may differ in their net cost depending on usage rate, enabling greater market share and profitability across a heterogeneous population of customers.

4 - Monotone Approximation of Decision Problems
Thomas Weber, Assistant Professor, Stanford University, Terman Engineering Center, Stanford, CA, 94305-4026, United States of America, webert@stanford.edu, Naveed Chehrazi

Many decision problems have the structural property that the objective function is a composition of different component functions which can be identified using empirical data. We consider the approximation of such objective functions, subject to monotonicity constraints. Using a constrained B-spline approximation we provide a data-driven robust optimization method for environments that can be sample-sparse. The method is illustrated for optimal debt settlement in the credit-card industry.

■ MD29

H-Room 501, Fifth Floor

Wind Power

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

Chair: Antonio J. Conejo, Professor, University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, antonio.conejo@uclm.es

1 - The Value of Compressed-Air Energy Storage (CAES) with Transmission-Constrained Wind
Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu, Paul Denholm

We examine the potential advantages of co-locating wind and CAES in order to increase transmission utilization and decrease transmission costs. Co-location of wind and CAES decreases transmission requirements, but also decreases the value of CAES compared to locating storage at the load. We examine three 'wind by wires' scenarios in the United States with a variety of transmission and CAES sizes to estimate the transmission costs required to justify co-locating CAES with wind.

2 - A Methodology to Generate Correlated Wind Speed Scenarios
Juan Miguel Morales, Engineer, University Castilla-La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, JuanMiguel.Morales@uclm.es, Roberto Mìnguez, Antonio J. Conejo

This paper provides a methodology to characterize wind speed uncertainty at different sites via scenarios. These scenarios are to be used within stochastic programming models to make informed decisions on wind power production. Each scenario embodies time dependencies and is spatially correlated with the scenarios describing other wind stochastic processes. A comprehensive case study is used to illustrate the capabilities of the proposed methodology. Appropriate conclusions are finally drawn.

3 - Some Impacts on Electricity Markets Given Integration of Large-Scale Wind Generation
William (Bill) Rosehart, University of Calgary, Department of Electrical and Computer Eng., Calgary, Canada, rosehart@ucalgary.ca, John MacCormack, Hamid Zareipour, Aidan Hollis

This work examines the effects of large-scale integration of wind generation. Hourly dispatch models of wind generation, load and resultant residual demand are combined with a probabilistic model of non-wind generator availability, a model of an energy-only market with a price cap, and a model of generator costs and dispatch behavior. The work evaluates the effect on electricity prices, reliability, and the fixed cost recovery of non-wind suppliers at different levels of wind penetration.

4 - Modeling of Flexibility in Power Systems with Large Amounts of Wind Power
Aidan Tuohy, University College Dublin, Belfield, Dublin 4, Ireland, aidan.tuohy@ucd.ie, Mark O' Malley

As wind power installed on a power system increases, the flexibility of the power system to deal with large amounts of this variable energy source becomes more important. Therefore, correct modelling of operation of flexible resources is needed. The flexibility of a power system is examined, looking at elements such as conventional plant, storage, interconnection, demand side resources, transmission and market operation. The effect of operational policies for these elements is presented.

■ MD30

H-Room 502, Fifth Floor

Forestry VI: Biofuel Supply Chain

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

Chair: Hayri Onal, Department of Agricultural and Consumer Economics, Univeristy of Illinois, Urbana-Champaign, Urbana, IL, 61801, United States of America, h-onal@uiuc.edu

1 - Consideration of Agricultural and Energy Market Dynamics in Analysis of Biofuels Market Penetration
Ozge Kaplan, U.S. Environmental Protection Agency, Research Triangle Park, NC, United States of America, kaplan.ozge@epa.gov

This study examines feedbacks between agriculture production, energy supply, and environmental quality through linking an energy and environment modeling system (U.S. EPA's Markal model) with an ag-econ modeling system (FAPRI suite of models). We analyze the impact of biofuels while incorporating

the interactions between energy and agricultural markets, and investigate specifically how this interaction influences the development of the market for biomass feedstocks.

2 - Understanding the Evolving Supply Chain of Biofuels: The Case of Jatropha Curcas

Ahu Soylu, Management Science and Operations, London Business School, London, United Kingdom, asoylu.phd2006@london.edu

This paper examines the operational risks in the dynamic and emergent nature of the supply chain of biofuel from Jatropha curcas. A simulation model has been developed for the supply chain from plantations to refineries and different operational models, managed plantations and contract farming, are compared under different scenarios.

3 - Strategic Biofuel Supply Chain Design under Uncertainty

Yongxi Huang, PhD candidate, University of California, Department of Civil Engineering, Davis, CA, 95616, United States of America, yxhuang@ucdavis.edu, Yueyue Fan

A sustainable energy infrastructure system serves long-term societal needs and must be able to suitably adapt to future changes and more importantly hedge against future uncertainties. We formulate a multistage model for optimal design and operation of a biofuel supply chain system, in order to enhance the system reliability and efficiency of the entire ethanol supply chain over time.

4 - Cournot Competition in Biofuel Production with Government Support

Xiangrong Liu, PhD Candidate, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, xl35@drexel.edu, Hande Benson

The biofuel boom, leading to a jump in food prices due to the diversion of farms' land assignments, motivates our investigation on the effect of government support on farms' production planning. A bilevel model with Cournot competition among two farms with two usages is extended to an MPEC model considering multiple farms with multiple alternatives

■ MD31

H-Room 503, Fifth Floor

Tutorial: Learning and Earning in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Assaf Zeevi, Professor, Columbia University, Graduate School of Business, Uris Hall, Room 406, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

1 - Learning and Earning in Revenue Management

Assaf Zeevi, Professor, Columbia University, Graduate School of Business, Uris Hall, Room 406, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

Most studies in the OR/MS literature, including revenue management, consider settings where model primitives are assumed to be known a priori to the decision maker. In practice, this is rarely the case. We will describe several problems where full information on the underlying market characteristics is lacking and must be inferred indirectly via market response to any given price, which in turn is confounded by statistical noise. In this situation the decision maker confronts a trade-off between exploration of the demand environment (learning) and expected immediate profit (earning). Some approaches to handling such problems, including relevant analytical tools, will be surveyed in this talk.

■ MD32

H-Room 504, Fifth Level

Statistics of Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Jianqing Fan, Frederick L. Moore Professor of Finance, Princeton University, Dept of Operations Res & Fin. Eng., Princeton University, Princeton, NJ, 08540, United States of America, jqfan@princeton.edu

1 - Minimum Autocorrelation Functionals for Anomaly Detection in Dynamical Systems

Alexandre d'Aspremont, Princeton University, Dept of Operations Res & Fin Eng, Princeton University, Princeton, NJ, 08544, United States of America, aspremon@princeton.edu, Marco Cuturi, Jean-Philippe Vert

We propose new methodologies to detect anomalies in discrete-time processes taking values in a set Z. The method is based on the inference of functionals whose evaluations on successive states visited by the process have low autocorrelations. Deviations from this behavior are used to flag anomalies. The candidate functionals are estimated in a subset of a reproducing kernel Hilbert space associated with Z.

2 - Testing and Detecting Jumps Based on a Discretely Observed Process

Yingying Fan, Assistant Professor, University of Southern California, IOM Department, BRI 401B, University of Southern California, Los Angeles, CA, 90089, United States of America, fanyingy@marshall.usc.edu, Jianqing Fan

We propose a new nonparametric test for detecting jumps in asset prices using discretely observed data. Compared to the test in Ait-Sahalia and Jacod(2007), our test enjoys the same asymptotic properties but has smaller variance. These results are justified both theoretically and numerically. Thanks to the variance reduction, we also propose a new test procedure to locate the jumps. Jump identification problem thus reduces to a multiple comparison. We employ FDR approach to control type I error.

3 - Asset Pricing Tests in Short Panels

Robert Kimmel, Associate Professor, Ohio State University, Department of Finance, Ohio State University, rkimmel@chicagobooth.edu

Factor pricing models are used for performance evaluation, portfolio optimization, active risk budgeting, and style analysis. Most tests of factor models require a panel of returns with a longer size in the time dimension than in the cross-sectional dimension. Most datasets violate this requirement, so standard practice is to test the model on portfolio rather than individual asset returns. We provide an innovative way to test factor models with individual stock data instead of portfolios.

4 - Nonparametric Estimation for Levy-Type Processes

Song Chen, Professor, Iowa State University, Ames, IA, 50011-1210, United States of America, songchen@iastate.edu

We propose a nonparametric approach to estimating the drift, the scale, the mean of the Poisson process that describes the numbers of jumps, and the jump size distribution for Levy-type processes. Levy-type processes gneralize the continuous Gaussian component of Levy processes to a stable distribution. We show that methods based on regression and nonparametric deconvolution can be used for inference for the Levy-type processes.

■ MD33

H-Room 505, Fifth Floor

Empirical Research

Cluster: Economic Models in Operations Management
Invited Session

Chair: Vinayak Deshpande, Associate Professor, Purdue University, Krannert School of Management, 100 S Grant Street Rawls Hall 4022, West Lafayette, IN, 47907-2076, United States of America, vinayak@purdue.edu

1 - Data Analysis and Supply Chain Design for a Company

Ananth Iyer, Purdue University, 403 W. State Street, West Lafayette, IN, United States of America, aiyer@purdue.edu, Arun Radhakrishnan

We describe analysis of a individual item level dataset for a consumer product across a supply chain. The data analysis showed the time spent at each stage of the supply chain by individual units of product. Understanding supply chain flows enabled a supply chain design model to improve performance. Managerial insights from the model were then used to implement operational level changes. Insights from the model are now being generalized.

2 - Can Stock Price Movements Inform Operational Improvement Efforts?

Kamalini Ramdas, Professor, London Business School, kramdas@london.edu, Wei Li, Marc Lipson, Jonathan Williams

We examine whether stock price movements can be used to inform operational improvement efforts, in the context of the airline industry. Using data from the major US carriers, we examine the impact on stock prices of the key dimensions of airline service quality, and use this analysis as a source of suggestions for quality improvement efforts.

3 - Sales Forecasting with Financial Indicators and Experts' Input

Nikolay Osadchiy, PhD Candidate, New York University, 44 West 4th St, New York, NY, 10012, nosadchi@stern.nyu.edu, Vishal Gaur, Sridhar Seshadri

We model sales of a retailer as a function of the sales forecast, the term of the forecast, and the return on a broad market index over the term of the forecast. The empirical estimation of the model shows that a significant part of forecast errors can be explained by the market return. We present a method of augmenting the sales forecasts with market returns and improving their accuracy. The accuracy improvement can exceed 15% in the out-of-sample tests and lead to substantial profit increase.

4 - An Empirical Estimation of the Impact of Airline Flight Schedules on Flight Delays

Vinayak Deshpande, Associate Professor, Purdue University, Krannert School of Management, 100 S Grant Street Rawls Hall 4022, West Lafayette, IN, 47907-2076, United States of America, vinayak@purdue.edu, Mazhar Arikan

Airline flight delays have come under increased scrutiny lately, with FAA data revealing that airline on-time performance was at its worst level in 13 years in 2007. Our goal is to examine the impact of the scheduled time block allocated for a flight on on-time arrival performance. We combine empirical flight data published by BTS, with the Newsvendor framework from the Operations literature to conduct this analysis. Our results show that airlines systematically under-schedule flights.

■ MD34

H-Room 520, Fifth Floor

Modeling Decision Making in Humanitarian Relief Operations

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

Chair: Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch

1 - When Should a Non-Profit Firm Accept a Donation?

Hugh Medal, Doctoral Student, Industrial Engineering Department, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hmedal@uark.edu

Due to manpower and capacity constraints, a non-profit firm often cannot accept every donation. Hence, when a donation is offered, a decision must be made: how much should be accepted? Factors such as the cost of accepting the donation, anticipated future donations, and anticipated future demand influence this decision. In this study we present a model to aid non-profit firms in making the decision of whether or not to accept a particular donation when it is offered.

2 - An Analysis of Fundraising Strategies for Disaster Relief Operations

Tina Wakolbinger, University of Memphis, Fogelman College of Business 332, Memphis, TN, 38152, United States of America, t.wakolbinger@memphis.edu, Fuminori Toyasaki

Aid agencies involved in disaster relief are currently facing multiple changes and challenges in their environment: increasing demand for disaster relief, increasing competition for donations, and donors who are more demanding in terms of accountability. Aid agencies employ different strategies to deal with these trends. Using game-theory, we analyze the impact of three aid agencies' strategies: cooperation, differentiation, and allowing donors to earmark donations.

3 - Planning World Food Program Operations in the Somali Region of Ethiopia

Jarrod Goentzel, Exec Dir, MLOG Program, MIT, 77 Massachusetts Ave. E40-211, Cambridge, MA, 02139, United States of America, goentzel@MIT.EDU

WFP transports aid amidst insecurity in the Somali region of Ethiopia. We assess methods to mitigate risk, such as escorted convoys, and analyze the impact on transportation rates and transit time. We then use the Analytic Hierarchy Process to locate warehouses that expedite flows from port to beneficiary. The process of identifying and prioritizing objectives and of developing measures for various criteria yielded insights that could be useful for decision-making in other humanitarian contexts.

4 - System Dynamics Modeling of Humanitarian Relief Operations

Paulo Goncalves, Associate Professor, University of Lugano, Via Giuseppe Buffi, 13, Lugano, Switzerland, paulo.goncalves@lu.unisi.ch

Humanitarian organizations face increased challenges scaling capacity, improving operational efficiency, and operating in challenging environments. To address such challenges, managers in humanitarian organizations must understand the complexity characterizing relief operations. Yet, learning in such environments is difficult. The system dynamics approach provides managers with a set of tools that can help them systematically explore new strategies and better understand complex systems.

■ MD35

H-Sapphire A, Fourth Floor

Optimization in Radiotherapy II

Sponsor: Health Applications
Sponsored Session

Chair: Edwin Romeijn, Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - A Discrete-time Optimal Control Approach to Spatio-temporal Radiotherapy Planning

Archis Ghate, Asisstant Professor, Industrial and Systems Engineering, University of Washington, Seattle, WA, 98195-2650, United States of America, archis@u.washington.edu

Current state of the art in radiotherapy planning breaks planned dose into constant dose fractions delivered over several weeks. Spatial dose distribution over multiple organs at risk and tumor(s) is separately optimized a priori. We propose a novel spatio-temporal approach that exploits emerging advances in quantitative functional imaging. Specifically, we develop a discrete-time optimal control formulation to choose plans that react adaptively to patient's actual radiobiological response.

2 - Intra-fraction Motion in Intensity Modulated Radiation Therapy

Ehsan Salari, Ph.D. Student, University of Florida, ISE Department, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, esalari@ufl.edu, Edwin Romeijn

Patient motion during radiation treatment can compromise the quality of a treatment plan. Modeling and accounting for this uncertainty is challenging due to the potential asynchrony between the apertures used to deliver dose and movements of the organs. We propose a stochastic model that allows us to study the impact of the intra-fraction motion on the delivered dose distribution. This model can also be used as a basis for finding treatment plans that explicitly account for patient motion.

3 - Optimization Models for Radiation Therapy under Uncertainty

Fei Peng, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, feipeng@umich.edu, Edwin Romeijn, Mustafa Sir, Marina Epelman

In intensity-modulated radiation therapy for cancer, treatment is designed to deliver high radiation doses to tumors, while avoiding healthy tissues. Due to random shifts during treatment, significant differences between the dose derived via optimization-based treatment planning and the actual dose delivered can occur. We present optimization models that take these types of uncertainty into consideration as well as adapt the treatment in an off-line manner, and present experimental comparisons.

4 - Image Guided 4-D Optimization for IMRT

Behlul Saka, Ph.D. Student, Graduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu, Mark Langer, Ronald L. Rardin

In a clinical environment, the time span of a patient's radiation therapy is on the order of weeks which include 30-50 fractions rather than one big event. 4-D Intensity Modulated Radiation Therapy (IMRT) planning incorporates tumor changes across fractions provided by "Image Guided Radiation Therapy (IGRT)" technology. We present optimization models that update the treatment plans after every sub-sequence of fractions, and test our approaches on the simulated real world cases.

■ MD36

H-Sapphire B, Fourth Floor

2009 Pierskalla Competition Papers III

Sponsor: Health Applications
Sponsored Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

1 - Methicillin-Resistant S. Aureus Transmission Reduction Using Agent-Based Modeling and Simulation

Bruce Golden, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, bgolden@rhsmith.umd.edu, Sean Barnes, Ed Wasil

Methicillin resistant S. aureus (MRSA) is a significant ongoing problem in healthcare, causing many downstream effects, such as a longer length of stay for patients, higher costs, and fatalities. An agent-based simulation model is

developed to investigate the dynamics of MRSA transmission in a hospital. The simulation model is used to examine the effectiveness of various infection control procedures and to explore more specific questions relevant to hospital administrators and policymakers.

2 - Hedging Against Antiviral Resistance During the Next Influenza Pandemic Using a Secondary Antiviral

Joseph Wu, Assistant Professor, University of Hong Kong, 21 Sassoon Rd, Pokfulam, Department of Community Medicine, Hong Kong, Hong Kong - PRC, joewu@hku.hk

Many countries are stockpiling a single antiviral (Tamiflu) in anticipation of large-scale antiviral intervention during an influenza pandemic. The effectiveness of antiviral intervention is attenuated if antiviral resistance emerges and spreads due to the associated selective pressure. We use a stochastic mathematical to show that the spread of drug-induced antiviral resistance can be significantly reduced by using a small stockpile of a secondary antiviral.

3 - A Game-theoretic Framework for Estimating the Willingness-to-Pay for Health and for Expansion

Reza Yaesoubi, PhD Candidate, North Carolina State University, Campus Box 7906, 421 Daniels Hall, Raleigh, NC, 27511, United States of America, ryaesou@ncsu.edu

We propose a game-theoretic framework for estimating the willingness-to-pay (WTP) for health in markets where the health purchaser offers a menu of medical interventions, and each individual selects the intervention that maximizes her utility. The framework also introduces a measure for estimating the WTP for expanding the utilization of medical interventions. The numerical results from applying the framework to Colorectal Cancer screening tests will be presented.

■ MD37

H-Sapphire C, Fourth Floor

Understanding Operations as an Investor

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Vishal Gaur, Associate Professor, Johnson School, Cornell University, vg77@cornell.edu

1 - Do Equity Analysts (fully) Incorporate Inventory Information in Their Sales and Earnings Forecasts?

Saravanan Kesavan, Assistant Professor, University of North Carolina, CB #3490, McColl Building, Chapel Hill, 27516, United States of America, skesavan@unc.edu

This talk draws on research conducted for two separate projects that investigated the role of inventory in predicting sales and earnings for retailers. The primary focus of this talk is to investigate if equity analysts incorporate the inventory information in their sales and earnings forecasts of retailers. We find that anaysts' forecasts are significantly biased due to missing information contained in inventory.

2 - Ordering Decisions, Cost of Capital, and the Value of the Firm

Santiago Kraiselburd, Zaragoza Logistics Center, Gomez Laguna 25, 1, Zaragoza, Spain, skraiselburd@zlc.edu.es, Alejandro Serrano, Rogelio Oliva

We present a model of a firm where the equity cost of capital depends on the operational decisions. We give an expression for linking the cost of capital and the ordering quantities and study the mechanisms through which this interaction takes place. Using the CAPM, we find that, if risk comes from exogenous shocks, investor's risk decreases with order quantity and risk-averse investors should behave as risk-neutral agents. Our results call into question the usual approaches to assessing risk.

3 - Stock Price Implications of Operations Disruptions

William Schmidt, Doctoral Student, Harvard Business School, Wyss House, Boston, MA, 02163, United States of America, wschmidt@hbs.edu

We present findings of an empirical investigation into the sizes and time-series correlation of operations disruptions, and their impact on company enterprise value and stock price volatility. Results from a large sample event study are presented. Quantitative results are augmented with descriptive information gathered from case study research.

4 - Stock Market Pressure on Sales Reporting and Inventory Investment

Guoming Lai, McCombs School of Business, University of Texas, Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, guomingl@andrew.cmu.edu, Laurens Debo, Lin Nan

We study a game between a self-interested manager and rational investors. The manager is compensated based on the stock price and may manipulate the stock price by channel stuffing. Investors infer the amount of sales padded. We identify three factors that determine the manager's incentive on channel stuffing: the marginal effect, the boundary effect and the carryover effect. Moreover, we find that the manager may under- or over-invest inventory, both possible.

■ MD38

H-Sapphire D, Fourth Floor

Stochastic Dynamic Inventory Models

Cluster: Inventory Management
Invited Session

Chair: Qing Li, Associate Professor, Hong Kong University of Science and Technology, Dept of ISOM, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, imqli@ust.hk

1 - Inventory Control with Partial Batch Ordering

Tarkan Tan, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Pav F7, Eindhoven, 5600 MB, Netherlands, t.tan@tue.nl, Osman Alp, Tim Huh

We consider an infinite horizon, periodic-review single item production/inventory system with random demand and batch ordering, where a separate fixed cost is associated for ordering a batch. We allow the possibility of partial batches. We introduce an alternative cost accounting scheme to analyze the problem and we discuss several properties of the optimal solution. We also propose three heuristic policies, all of which perform very well for a wide range of problem parameters.

2 - Managing Supply Chain Inventory with Stock Disposals

Alexandar Angelus, Associate Professor, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, #04-90, Singapore, 178899, Singapore, angelus@smu.edu.sg

We analyze a multiechelon model where the firm can dispose of stock at each stage in the supply chain. Stock disposals complicate the system, so that the Clark and Scarf (1960) approach no longer applies. We find conditions under which it is optimal to never: (i) dispose of stock; (ii) both dispose of stock and order inventory. We identify a class of disposal policies that achieves the Clark-Scarf decomposition and reduces the optimal inventory policy to the classical echelon base stock policy.

3 - Optimal Control of Inventory Systems with Concave Ordering Costs

Yimin Yu, PhD Student, Industrial and Systems Engineering, University of Minnesota, 111 Church St. S.E., Minneapoolis, MN, 55455, United States of America, yimin@me.umn.edu, Saif Benjaafar

In this talk, we analyze inventory systems with concave ordering costs. We introduce a local monotone property for the optimal policy and a new generalized convexity property to show that the structure of the optimal policy for systems with piecewise linear concave ordering costs is a generalized (s,S) policy. We carry out the analysis under quite general assumptions on ordering costs and demand distributions.

4 - Optimal Policies for a Capacitated Series System

Wanshan Zhu, Assistant Professor in Operations Management, Singapore Management University, 50 stamford #0401, Singapore, 178899, Singapore, adamzhu@smu.edu.sg, Alexandar Angelus

We generalize the known two-echelon capacitated results of Parker and Kapuscinski (2004) to a capacities series system with arbitrary echelon. We prove that when the lowest capacity is at the bottom echelon and the capacity is tight, a branch echelon base stock policy is optimal and achieves the Clark-Scarf (1960) decomposition of the cost function. A numerical example evaluated for a three-echelon capacitated system illustrates the results and provides insight into the "push-ahead" effect.

■ MD39

H-Sapphire E, Fourth Floor

Operations Management in the Process Industries

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, krajaram@anderson.ucla.edu

1 - Interaction Between Technology and Extraction Scaling Real Options in Natural Gas Production

Paul Enders, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, penders@cmu.edu, Alan Scheller-Wolf, Nicola Secomandi

We analyze the interaction between the real options to scale the levels of employed extraction and communication technologies and the extraction rate using real data from Equitable Resources, a U.S. natural gas production company. We find that the values of these real options are highly interdependent and their optimal use is rather complex. We bring to light data-driven managerial principles guiding the use of these real options.

2 - A Multi-period Stochastic Inventory Model with Capacity Reservation

Youssef Boulaksil, Eindhoven University of Technology, P.O. Box 513, Pav E17, Eindhoven, 5600 MB, Netherlands, Y.Boulaksil@tue.nl, Jan Fransoo, Tarkan Tan

We consider a pharmaceutical firm that faces uncertain demand and that has to reserve capacity at its supplier, which produces on a non-dedicated production line. The firm also faces uncertain capacity, as reserved capacity slots are subject to (partial) rejection. A multi-period, periodic review inventory system is considered and we develop a dynamic programming model for this problem and show the structure of the optimal policy. Our numerical results reveal interesting managerial insights.

3 - Stochastic Facility Location in the Process Industry

Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, krajaram@anderson.ucla.edu, Jens Wollenwebber, Felipe Caro

We consider the facility location problem in the process industry. This problem differs from the traditional facility location problem due to characteristics that are unique to the process industry. We model this problem as a non-linear, mixed-integer program. We develop heuristics and bounds and applied our methods to data from a large food processing company. We show that our methods could potentially increase profits significantly.

4 - Carrier Allocation under Diesel Price Uncertainty

John Turner, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, jgt@andrew.cmu.edu, Sunder Kekre, Benjamin Peterson, Soo-Haeng Cho, Alan Scheller-Wolf

Motivated by recent swings in diesel prices, we study the problem of allocating full truckload carriers to transportation lanes in the presence of diesel price uncertainty. We allow carriers to specify their fuel surcharge schedules, as well as a fuel surcharge cap beyond which fuel surcharges are not levied. Going forward, a decision support tool based on our model will be used by a large U.S. retailer to price and negotiate contracts with its carriers.

■ MD40

H-Sapphire H, Fourth Floor

Numerical Methods for Stochastic Control Problems in Finance

Sponsor: Financial Services
Sponsored Session

Chair: Stathis Tompaidis, Associate Professor, University of Texas at Austin, McCombs School of Business, IROM Department, Austin, TX, 78712, United States of America, Stathis.Tompaidis@mccombs.utexas.edu

1 - A Dynamic Programming View of the Smooth Pasting Condition in Multiple Dimensions

Adam Speight, Assistant Professor, Georgia State University, 197 15th St NW, Atlanta, GA, 30318, United States of America, aspeight@gmail.com

I present a interpretation of the smooth pasting condition based on dynamic programming. Fourier analysis of the smooth-pasting condition shows local changes to the free boundary have negligible effects on the value function. Thus, any local discretization will fail to resolve fine details of the boundary. I develop a preconditioner that renders the smooth pasting condition elliptic, which has a direct probabilistic interpretation in terms of the local time spent near the free boundary.

2 - Moving Boundary Approach to Solving Optimal Stopping Problems

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

This talk will focus on introducing a computational method that can solve a large class of optimal stopping time problems. Using the classical American option pricing problem, we will describe the method. We will then consider the much harder problem of pricing American options when the volatility of the underlying asset price is stochastic. Here we take a canonical setup that is general enough to encompass several stochastic volatility models proposed in literature.

3 - A State Variable Decomposition Methodology for Solving Portfolio Choice Problems

Lorenzo Garlappi, University of Texas at Austin, McCombsr School of Business, Ausitn, TX, 78712, United States of America, lorenzo.garlappi@mccombs.utexas.edu, Georgios Skoulakis

We develop a new method for the solution of discrete-time dynamic portfolio choice problems. The method efficiently approximates conditional expectations of the value function by using a decomposition of the state variables and a Taylor expansion of the value function. We illustrate the accuracy of the method in handling several features of portfolio choice problems.

4 - A Simulation Algorithm for Solving Dynamic Portfolio Choice Problems

Chunyu Yang, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, chunyu.yang@phd.mccombs.utexas.edu

We develop a simulation-based algorithm to solve dynamic portfolio choice problems under constraints by solving the first order, Karush-Kuhn-Tucker (KKT), conditions. To approximate the conditional expectations in the KKT conditions, we apply a functional approximation approach with cross-test-solution regressions and introduce an iterative method to shrink the approximation region. A numerical example with CRRA preferences, an income stream, and margin requirements is provided.

■ MD41

H-Sapphire L, Fourth Floor

Training Technologies for Emergency Preparedness

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

1 - Sand Table Training Methods for Emergency Preparedness

Stephen Guerin, Redfish Group, stephen.guerin@redfish.org

We demonstrate new developments in three-dimensional sand table training using new visualization techniques and agent-based modeling.

2 - Simulation Table Methods for Emergency Preparedness

Charles Curtis, chas@simtable.com

We discuss new methods and applications in simulation-based training technology.

3 - Discussant

Doug Samuelson, President / Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

■ MD42

H-Sapphire P, Fourth Floor

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research Practice

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

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

1 - Integrated Framework for Product Costing, Demand Forecasting and Capacity Planning of New Photovoltaic Technology Products

Bex George Thomas, General Electric Global Research, Computing and Decision Science, 1 Research Circle, Niskayuna, NY, 12309, thomasb@ge.com, Srinivas Bollapragada

GE Energy's nascent solar business has revenues of over $100 million, and may exceed $1 billion in the next few years. GE Global Research is pursuing a number of technological alternatives to bring new low cost solar products to the market. We developed analytical decision support tools with embedded mathematical models to estimate product costs and demands, and to support capacity planning decisions in the presence of major uncertainties in technology, costs, demands, and energy policy.

2 - Optimizing Helicopter Transport of Oil Rig Crews at Petrobras
Hernàn Abeledo, Associate Professor, The George Washington University, 1776 G St NW, Washington, DC, 20052, United States of America, abeledo@gwu.edu, Lorenza Moreno, Fernanda Menezes, Nelci Nascimento, Marcus Poggi de Aragão, Oscar Porto, Marcelo Reis, Eduardo Uchoa

Petrobras carries over 1900 workers daily by helicopter to about 80 offshore oil platforms. This operation is among the largest worldwide for civilian helicopters. We present a flight scheduling system designed to improve service and minimize cost. Achievements comprise strict enforcement of safety guidelines, reductions of 18% in number of offshore landings, 8% in total flight time, and 14% in flight costs. The optimization model, involving routing and packing, is solved by column generation.

■ MD43

H-Room 400, Fourth Floor

Managing Supply Uncertainties

Cluster: Supply Chain Models
Invited Session

Chair: Annabelle Feng, Assistant Professor, University of Texas-Austin, McCombs School of Business, 1 Univresity Station B6500, Austin, TX, 78712-0201, United States of America, annabelle.feng@mccombs.utexas.edu

1 - Leadtime, Reliability, and Procurement Cost
Burcu Tan, PhD Candidate, University of Texas at Austin, IROM, B6500, 1 University Station, Austin, TX, 78712, United States of America, Burcu.Tan@phd.mccombs.utexas.edu, Annabelle Feng

We consider an inventory manager who can source from two unreliable suppliers with different lead times. The capacity of each supplier is uncertain upon ordering, which leads to a nonconvex cost evaluation of the ordering strategy. We use DP to explore the optimal procurement strategy for different levels of net inventory, cost parameters, and supplier reliability. We analyze the trade-offs between lead time, reliability and procurement cost in determining the optimal supplier base.

2 - Pricing During Disruptions: A Cause of the Reverse Bullwhip Effect
Ying Rong, University of California-Berkeley, Dept of IEOR, Berkeley, CA, United States of America, yir204@lehigh.edu, Max Shen, Larry Snyder

Because supply disruptions occur infrequently, consumer behavior during disruptions can be difficult to predict, and this poses a great challenge to firms. We examine three different pricing strategies that may be used by a firm that only possesses limited information about its strategic customers. We find that the simplest proposed pricing strategy outperforms the other two in terms of both the stability of the customer order process and the firm's revenue.

3 - New Results on Bargaining Power and Supply Base Diversification
Zhixi Wan, Assistant Professor, HEC Paris, 1, Rue de la Libération, Jouy en Josas cedex, 78351, France, wanzhixi@umich.edu, Damian Beil

We consider a buyer who periodically holds auctions to award short term supply contracts among a cohort of suppliers (i.e., the supply base). To mitigate significant cost shocks to procurement, the buyer can diversify her supply base by selecting suppliers from different regions. We find that the more bargaining power the buyer has the more she prefers a diversified supply base. We also examine the effect of the asymmetry between regions on the buyer's optimal diversification strategy.

■ MD44

H-Room 402, Fourth Floor

Measurement of Value in Services Systems

Sponsor: Service Science
Sponsored Session

Chair: Ruoyi Zhou, Services Research Manager, IBM, 650 Harry Road, San Jose, CA, 95120, United States of America, ruoyi@us.ibm.com

1 - Determining Quantitative Value in Services
Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

We present a step-by-step method to determine the quantitative economic value of business services. The distinction is important, consumer buying behavior is affected by psychological factors. In business the fundamental and dominant criteria for engaging a service provider are grounded on quantitative economic value. Moreover, the decision making units are organizations, not individuals. We present examples. We also discuss the very fundamental difference between price and value.

2 - Customer Lifetime Value in Contractual Settings
Christoph Heitz, ZHAW Zurich University of Applied Sciences, Technikumstrasse 9, Winterthur, Switzerland heit@zhaw.ch, Andreas Ruckstuhl, Marcel Dettling

Service provision is often governed by a contract (e.g. newspaper subscriptions, phone contracts, credit agreements). Typically, such a contract includes rules for preventing the customer to switch to a competitor, and thus influencing the autonomous dynamics of the customer in the marketplace. We analyze the problem of calculation of customer lifetime value (CLV) under general contract structures, and address the problem of estimating the CLV from available customer data.

3 - Value Measurement in Complex Service Systems
Ray Strong, IBM Almaden Research, strong@almaden.ibm.com, Ruoyi Zhou, Tianwei Chen

A Service System is a dynamic configuration of people, processes, and technology in which co-creation of value takes place between a service provider and a client. In complex service systems, either the provider or the client may also be service systems. Contrary to many approaches to measuring value in service systems, our approach is based on the realization that value is not intrinsic to the process but rather depends on the point of view, as exemplified by such abstractions as "win-win.a"

■ MD45

H-Room 410, Fouth Floor

Panel Discussion: Research Priorities in Innovation

Cluster: New Product Development
Invited Session

Chair: Sanjiv Erat, University of California San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, serat@ucsd.edu

1 - Research Priorities in Innovation
Moderator: Sanjiv Erat, University of California San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, serat@ucsd.edu, Panelists: Kamalini Ramdas, Christian Terwiesch, Bruno Cassiman

The panel will feature the new Department Editors of Management Science, Kamalini Ramdas, Christian Terwiesch, and Bruno Cassiman. The discussion shall encompass both priorities for the journal, as well as a broader discussion of the 'burning' research questions in Innovation. The main goal will be to exchange ideas, views, opinions about what areas in Innovation are under-researched and why, and to help spur new research and collaborations.

■ MD46

H-Room 411, Fourth Floor

Joint Session Tech Mgt/NDP: TMS Distinguished Speaker: Marvin Lieberman

Sponsor: Technology Management & New Product Development
Sponsored Session

Chair: Francisco Veloso, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, fveloso@cmu.edu

1 - Perspectives on Technology and Market Entry: Themes From Business Strategy

Marvin Lieberman, Professor of Policy, UCLA, Anderson School of Management, Los Angeles, CA, United States of America, marvin.lieberman@anderson.ucla.edu

A critical issue associated to all new technologies is the decision to enter the market. TMS Distinguished Speaker Marvin Lieberman will present an integrated perspective on the the relation between technology and market entry, connecting topics such as first-mover advantage, imitation processes, disruption, industry life cycle, and implications of the learning curve.

■ MD47

H-Room 412, Fourth Floor

Tutorial: Modeling Static Competitive Facility Location Problems: New Approaches and Results

Cluster: Tutorials
Invited Session

Chair: Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu

Co-Chair: Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5E 3E6, Canada, Berman@Rotman.Utoronto.Ca

Co-Chair: Dmitry Krass, Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca

1 - Modeling Static Competitive Facility Location Problems: New Approaches and Results

Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu, Oded Berman, Dmitry Krass, Tammy Drezner

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

■ MD48

H-Sapphire Green Room, Fourth

Workshop: Research Opportunities in Hospitality and Services

Cluster: Hospitality
Invited Session

Chair: Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

1 - Research Opportunities Available via Cornell Center for Hospitality Research

Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu, Liana Victorino

This presentation will provide an overview of resources available at the Cornell University's Center for Hospitality Research (CHR) for conducting a wide range of research projects on topics related to service operations (e.g. revenue management, operations strategy, financial analysis). We will also discuss how corporations can participate in many different activities supported by CHR.

■ MD49

H-Room 300, Third Floor

Workforce Analytics in Service Systems

Cluster: Workforce Engineering and Management
Invited Session

Chair: Gyana Parija, IBM Research, ISID Institutional Area, New Delhi, India, gyana.parija@in.ibm.com

1 - A Bayesian Analysis and Optimization Framework for Optimal Project Staffing

Aleksandra Mojsilovic, aleksand@us.ibm.com, Jianying Hu, Mark Squillante, Afsaneh Shirazi, Moninder Singh

We describe a methodology to determine the impact of various staffing factors on project success and apply it to staff individual projects to maximize an overall business objective. We use Causal Bayesian Network to identify key delivery factors and develop a novel approach for collective delivery optimization by treating each active project as an instance of the model. We test the approach and demonstrate its benefits on actual IBM service delivery data.

2 - Multi-Skilling Workforce in Service Organizations

Rohit Lotlikar, Research Staff Member, IBM - India Research Lab, EGL, Block D, Domlur Ring Rd, Bangalore, KA, 560071, India, rohitmlo@in.ibm.com, Gyana Parija, Sambuddha Roy, Karthik Visweswariah, Kashyap Dixit, Pranav Gupta, Nanda Kambhatla, Debapriyo Majumdar

Cross-training and job rotation programs are common practices for growing and aligning the capabilities of people in a service unit with evolving needs of the marketplace. We describe a solution for developing effective and least-cost cross-training and rotation programs. Our approach involves identifying multi-dimensional skill gaps in the organization and estimating the cross-learnability of various skills by learning from skill and Resume information on practitioners.

3 - A Mathematical Programming Approach to Improve Seat Utilization for Global Service Delivery Systems

Pranav Gupta, IBM - India Research Lab, Vasant Kunj Inst Area, Delhi, India, prguptan@in.ibm.com, Gyana Parija

Physical space and infrastructure are two important cost drivers for any business. Optimum utilization of such resources can bring huge savings. This paper proposes a MIP to improve utilization of "physical seats:", from where an agent delivers services in a 24x7 delivery setting. We solve the problem by decomposing it into a covering problem and a generalized version of 2-D bin packing problem using MOLP technique. Approximation algorithm is proposed for the later problem for large instances.

■ MD50

H-Room 302, Third Floor

Joint Session SpORts/EDU: Teaching Sports Modeling

Sponsor: SpORts & Education
Sponsored Session

Chair: Michael Magazine, University of Cincinnati, Dept of QAOM, Cincinnati, OH, United States of America, magazim@ucmail.uc.edu

1 - HERBIE and DIPS - NLP Modeling of MLB Pitchers' Earned Run Averages in the Classroom

James Cochran, Associate Professor, Louisiana Tech University, College of Business, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

Several baseball analysts have suggested various functional relationships between an MLB pitcher's ERA and his defense independent pitching statistics (the number of homeruns, walks, and strikeouts he yields). These include DIPS (for Defense Independent Pitching Stats) and HERBIE (for HRBB). We discuss our use of NLP modeling in the classroom to examine whether there are superior functional forms of this relationship.

2 - Pedagogy of Quantitative Analysis Via Sports

Jeffrey Ohlmann, University of Iowa, 108 John Pappajohn Business Bldg., Iowa City, United States of America, jeffrey-ohlmann@uiowa.edu

In this talk, I discuss my experience motivating the development of students' quantitative skills using sports. In particular, I will describe a freshman seminar in quantitative analysis, a case study targeted primarily for the MBA audience, and the use of sports examples to teach mathematical programming techniques.

3 - Team Teaching a Sports Statistics Course
Kellie Keeling, Assistant Professor, University of Denver, DCB Department of Statistics, MSC 8952, 2101 S. University Blvd., Denver, CO, 80208-8952, United States of America, kkeeling@du.edu

I will discuss my experiences team teaching a sports statistics special topics course. This course is offered before the fall quarter during a one-week interterm. Specifically I will talk about the purpose of the course, the design of the course instruction, the coverage of statistical topics, and the administration of student assignments.

4 - Teaching Sports Modeling at UC
Michael Magazine, University of Cincinnati, Dept of QAOM, Cincinnati, OH, United States of America, magazim@ucmail.uc.edu

We have been fortunate to start an alliance with ESPN, where they send us problems they would like investigating. This past year we had our first offering with 5 students working on 5 of these projects without ESPN involvement. The course ran for 2 quarters. The first nailing down a detailed problem statement, hypothesis development and data exploration. The second quarter was to analyze data, make corrections, develop conclusions and write reports.

■ MD51

H-Room 303, Third Floor

Mathematical Programming for Clustering

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

Chair: Yan Jiang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, jiangyan1984@gmail.com

1 - Solving a Capacitated Clustering Problem with GRASP
Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712, United States of America, jbard@mail.utexas.edu, Yumin Deng

This talk presents a GRASP coupled with path relinking to solve a capacitated clustering problem. In Phase I, a heaviest weight edge algorithm and a constrained minimum cut algorithm are used to select seeds for initializing the clusters. A self-adjusting restricted candidate list is then used to guide the assignment of the remaining nodes to obtain a feasible solution. In Phase II, three neighborhoods are explored. Extensive testing was performed on instances up to 100 nodes.

2 - Strategy For Predicting Immunity of Vaccines
Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

This talk focuses on developing methodologies to predict the immunity of a vaccine without exposing individuals to infection. We will describe feature-selection and classification model that Identify distinct gene signatures that can predict the magnitude of T cell response and the antibody response induced by the vaccine. The work is joint with Dr. Pulendran from Emory Vaccine Center.

3 - Spectral Methods in Mining Data Biomedical and Social Networks
Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petros.xanthopoulos@gmail.com, Panos Pardalos

Spectral methods have become very popular as clustering tools in computer vision and more specifically in image segmentation. In this paper we discuss potential application of spectral graph methods into mining information from networks appearing in biomedicine and in the so called small world networks.

4 - A Branch-and-price Algorithm for Clusterwise Linear Regression
Yan Jiang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, jiangyan1984@gmail.com

We present a branch-and-price algorithm for performing clusterwise linear regression. The clusterwise linear regression problem is to find clusters such that the overall sum of squared errors in regression within the clusters is minimal. The proposed algorithm is applied in the retail promotion planning to group products according to their seasonal effects. The pricing problem is a specialized MIP, which is shown to be NP-complete.

■ MD52

H-Room 304, Third Floor

Operations and Marketing Decisions

Cluster: Operations Management/Marketing Interface
Invited Session

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

1 - Dual Sourcing in a Volatile Commodity Market
Mojisola Otegbeye, Graduate Assistant, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States of America, mko3@njit.edu, Jian Yang

We derive procurement policies tailored towards a buyer's risk attitude, where the price of the commodity fluctuates and the buyer seeks an optimal allotment policy for a dual procurement framework. The buyer can source his needs via contract with a supplier and the spot market. A risk sharing contract is proposed for the supplier-buyer relationship. A highlight of our work is the concept of a floating contract price, with the final price contingent on the future realization of the spot price.

2 - Integrated Marketing and Capacity Contracting for Capital-Intensive Service Systems
Yabing Jiang, Fordham University, 113 W 60th St, New York, United States of America, yajiang@fordham.edu, Abraham Seidmann

Effectively managing service facilities is challenging because firms need to maximize capacity utilization and control customer delays at the same time. Traditionally, incentive contracting and operational capacity decisions are made independently and by different parties. Thus these centers often operate at a suboptimal profit level. To tackle the management challenges we take an integrated approach by incorporating operational delay and capacity decisions with the incentive contract design.

3 - Analysis of Marketing and Operations Strategies to Prevent Product Counterfeiting
Gregory DeYong, Student, Indiana University, 1309 E. Tenth St., Bloomington, IN, 47405, United States of America, gdeyong@indiana.edu

We mathematically model strategies to combat the counterfeiting of products by unauthorized manufacturers. The strategies include marketing to reduce the appeal of cloned products, product changes to increase the cost of cloned products and a mixed strategy combining the two approaches. Effectiveness of the strategies is examined.

4 - The Joint Decisions of Price, Quality, and Marketing Effort
Gongtao (Lucy) Chen, Assistant Professor, National University of Singapore, 1 Business Link, NUS Business School, Singapore, 117592, Singapore, bizcg@nus.edu.sg

Price, quality and advertising are three key strategic decisions firms need to make. In this paper we study the relationships and interactions among them by looking at a simple supply chain with one manufacturer and one retailer. Using a centralized supply chain as the benchmark case, we investigate the optimal decisions of the price, quality and advertising level in a decentralized supply chain.

5 - When and Why Retailers Sell Their Private Labels Through Competitors?
Liwen Chen, PhD Candidate, The University of Texas at Austin, Department of IROM, McCombs School of Business, Austin, TX, 78703, United States of America, liwen.chen@mail.utexas.edu, Steve Gilbert, Yunchuan Liu

We consider a supply chain consisting of a national brand manufacturer and two retailers who distribute the national brand to consumers. One of the retailers has the capability of selling her own private label. We study the strategic issues of when and why the retailer with private label capability sells the private label through the competitor.

■ MD53

H-Room 305, Third Floor

Mixed-Integer Programming with Chance Constraints

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Simge Kucukyavuz, Ohio State University, Columbus, OH, 43202, United States of America, kucukyavuz.2@osu.edu

1 - Probabilistic Set-covering with Correlations
Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, School of Industrial & Systems Engineeri, 765 Ferst Drive, Atlanta, GA, 30332, sahmed@isye.gatech.edu, Alper Atamturk, Dimitri Papageorgiou

We consider integer programming models for probabilistic set covering problems with correlated uncertainties. By exploiting the sub- and super-modularity properties of the probabilistic covering constraints and analyzing their polyhedral structure, we develop strong valid inequalities to strengthen the formulations.

2 - An Integer Programming Approach for Optimization with General Probabilistic Constraints
Jim Luedtke, University of Wisconsin-Madison, 3236 Mechanical Engineering, 1513 University Ave, Madison, WI, 53711, United States of America, jrluedt1@wisc.edu

We discuss how the integer programming approach which has been successfully applied for probabilistic constraints (also called chance constraints) with random right-hand side can be extended for general probabilistic constraints. Preliminary computational results will be presented.

3 - Disjunctive Normal Form Representation of Probabilistic Constraints
Miguel Lejeune, Assistant Professor, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

We present an approach to reformulate a probabilistic constraint as a Boolean function. We extend the Boolean function as a disjunctive normal form. We analyze its functional properties and use them to derive a solution method for probabilistically constrained optimization problems

■ MD54

H-Room 306A, Third Floor

Approximation and Online Algorithms

Sponsor: Optimization/Networks
Sponsored Session

Chair: Mohit Singh, Microsoft, One Microsoft Way, Redmond, WA, 98052, United States of America, mohsingh@microsoft.com

1 - Incentives in Online Auctions and Secretary Problems
Niv Buchbinder, Microsoft Research, 1 Memorial dr., Cambridge, MA, 02142, United States of America, nivbuchb@microsoft.com, Kamal Jain, Mohit Singh

Online auctions in which items are sold in an online fashion with little knowledge about future bids are common in the internet environment. We study a problem in which an auctioneer would like to sell an item. A bidder may make a bid at any time but expects an immediate decision. We study the issue of incentives in the online auction problem where bidders are allowed to change their arrival time if it benefits them. We show a LP based technique as a basic framework for analyzing the problem.

2 - Better Algorithms for Benign Bandits
Satyen Kale, Postdoctoral Researcher, Microsoft Research, 1 Memorial Drive, Cambridge, MA, 02138, United States of America, satyen.kale@gmail.com, Elad Hazan

We consider the non-stochastic bandit linear optimization problem, which is a repeated decision making problem where the set of decisions is a convex set in some Euclidean space, and the cost functions are linear. We propose a new algorithm for the bandit linear optimization problem which obtains a regret bound of O(sqrt{Q}), where Q is the total variation in the cost functions.

3 - A General Approach for Incremental Approximation and Hierarchical Clustering
Chandrashekar Nagarajan, Scientist, Yahoo! Inc, 2821 Mission College Blvd, 2GA-5226, Santa Clara, 95054, United States of America, chandra@orie.cornell.edu, Rajmohan Rajaraman, Guolong Lin, David Williamson

We present a general framework and algorithmic approach for incremental approximation algorithms. The framework handles cardinality constrained minimization problems, such as the k-median and k-MST problems. For these problems we either get new incremental algorithms, or improvements over what was previously known. We also show that the framework applies to hierarchical clustering problems. This gives an improved algorithm for a hierarchical version of the k-median problem introduced by Plaxton.

■ MD55

H-Room 306B, Third Floor

Supply Chain Risk Management and Multiple Sourcing

Sponsor: MSOM/ iFORM
Sponsored Session

Chair: Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

1 - Independence of Capacity Ordering and Financial Subsidies to Risky Suppliers
Volodymyr Babich, University of Michigan, 1205 Beal Avenue IOE 2783, Ann Arbir, MI, 48109, babich@umich.edu

We study joint capacity reservation and financial subsidy decisions of a manufacturer, dealing with a risky supplier whose financial state is described by a general firm-value model. General assumptions permitting the manufacturer to make ordering decisions independently from subsidy decisions are presented. Consequences of relaxing these assumptions are discussed. Conditions are presented for the optimal subsidy policy to have a subsidize-up-to structure.

2 - Safety Stock or Excess Capacity: Trade-offs under Supply Risk
Aadhaar Chaturvedi, IESE Business School, Avda. Pearson 21, Barcelona, 08034, Spain, achaturvedi@iese.edu, Victor Martinez de Albeniz

This paper investigates the trade-off between carrying high safety stock and planning for excess capacity, when a firm faces uncertain demand and supply. We use results from queueing theory to characterize a buyer's optimal strategy for the amount of capacity that it should contract from a supplier and the corresponding inventory that it needs to hold. Typically both are higher when demand or supply variability are higher. In addition, we apply our model to optimize multi-sourcing strategies.

3 - Sourcing Strategies for Short Life-Cycle Goods
Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Eduard Calvo

A buyer can source a product from different suppliers, each one having a different price and lead-time. A faster supplier provides the advantage of using a more accurate forecast, but this usually involves a higher cost. We characterize the optimal sourcing strategy under different scenarios such as single-sourcing and sequential multi-sourcing. In addition, we study the suppliers' competitive dynamics and find the prices that suppliers with different lead-times will quote in equilibrium.

■ MD56

H-Room 307, Third Floor

Optimization and Equilibrium Problems: Theory, Distributed Algorithms and Decomposition Schemes

Sponsor: Optimization/Nonlinear Programming
Sponsored Session

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

1 - Nash Equilibrium Problems with Congestion Costs and Shared Constraints
Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu, Huibing Yin, Prashant Mehta

We consider a noncooperative game in which agents face a congestion cost and contend with shared network constraints. Under a broad set of assumptions on the congestion costs (such as nonsmoothness), we provide existence results for the resulting generalized Nash equilibrium problem (GNEP). Uniqueness properties of related problems are also examined. Distributed dual and primal-dual schemes for computing the GNE are also presented.

2 - Asynchronous Gossip Algorithms for Stochastic Optimization
Angelia Nedich, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, United States of America, angelia@uiuc.edu, Sundhar Ram Srinivasan, Venu Veeravalli

We consider a distributed network system where the goal is to minimize the sum of functions, each of which is known with stochastic errors to a specific network agent. We propose an asynchronous algorithm based on a random gossip

scheme. We investigate the algorithm's convergence for differentiable nonconvex and convex nondifferentiable functions.

3 - Distributed Multiuser Optimization: Algorithms and Error Analysis
Jayash Koshal, Student, Industrial and Enterprise System Engineering, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, koshal1@illinois.edu, Angelia Nedich, Uday Shanbhag

We consider a multiuser problem of minimizing a sum of convex objective functions where user interactions are seen through either congestion cost functions or coupling constraints. We focus on distributed primal, primal-dual and dual schemes and analyze their convergence properties. We provide error bounds in regimes where a group of users terminate prematurely or when inexact primal solutions are obtained in the dual algorithm. Finally, we report some preliminary computational evidence.

4 - Second-Order Barrier Lagrangian Schemes For Stochastic Nonlinear Programming
Deanne Zhang, Paragon Decision Technology, 5400 Carillon Point, Kirkland, WA, 98033, United States of America, Deanne.Zhang@aimms.com, Uday Shanbhag

Lagrangian methods have proved successful for large-scale nonlinear programs. However, existing implementations can only provide convergence to first-order KKT points and the incapable with generalizations arising from addressing uncertainty. In this paper, we address precisely these two concerns, through the use of a barrier-Lagrangian method that employs Newton and negative curvature directions for computing second-order KKT points and decomposition schemes for stochastic nonlinear programs.

■ MD57

H-Room 308, Third Floor

OR in Public Health

Sponsor: Health Applications
Sponsored Session

Chair: Arielle Lasry, CDC, 1600 Clifton, Atlanta, United States of America, ftn9@cdc.gov

1 - Health Economic Assessment of Community Based CVD Risk Reduction Programs
Anke Richter, Associate Professor, DRMI / Naval Postgraduate School, 699 Dyer Rd, Bld 234, Monterey, CA, 93943, United States of America, arichter@nps.edu, Patricia Thieda

Austria runs community-based programs to reduce CVD risk factors. A health economic assessment was conducted using the QRISK2¬© model incorporated into an event-based simulation constructed in Excel. Costs are assessed from the perspective of the health ministry. Benefits include reduced numbers of cardiovascular events, reduced years of life spent in a diminished health state, and gains in life years. This tool compares different interventions to ensure that they provide good value for money.

2 - Calibrating the Effects of Knowledge of HIV Status in a Transmission Model Against Epidemiology Data
Stephen Sorensen, Mathematical Statistician, Centers for Disease Control, 1600 Clifton Road, M/S E48, Atlanta, GA, 30333, United States of America, zuc7@cdc.gov, Stephanie Sansom

Behavioral studies show that individuals aware of their HIV status engage in fewer risky behaviors, resulting in a significant reduction in HIV transmission. We built awareness of HIV serostatus into a dynamic, compartmental HIV transmission model of MSM in an urban setting. We explored the challenges of calibrating the model's estimates of infections to those observed in longitudinal epidemic surveillance data. We applied the model to an HIV screening program to increase awareness.

3 - Cost Efficiency of HIV Counseling and Testing Using Social Networks
Ram Shrestha, Economist, Centers for Disease Control and Prevention, 1600 Clifton Rd NE, MS E-48, Atlanta, GA, 30333, United States of America, biu0@cdc.gov, Stephanie Sansom

We used Data Envelopment Analysis (DEA) to evaluate the cost efficiency of a social network strategy, as delivered by 4 community-based organizations, to recruit clients for HIV counseling and testing and deliver new HIV diagnoses. We found that the least efficient two programs operated at about 70% of the cost efficiency of the most efficient two programs. We discuss the reasons behind the variation in cost efficiency, and the challenges of using DEA in HIV program delivery.

4 - Priority Setting for HIV Prevention Resources
Arielle Lasry, CDC, 1600 Clifton, Atlanta, United States of America, ftn9@cdc.gov, Stephanie Sansom, Katherine Hicks, Vladislav Uzunangelov

We model the allocation of HIV prevention funds in the US to over 90 combinations of populations and interventions. We use a non-linear optimization program that aims to select the funding amounts such that HIV incidence is minimized. The model may be used to help decision-makers understand the impact of trade-offs and deviations from the optimal funding scenario and evaluate the benefits of any additional funds. Results will be presented and discussed.

■ MD58

H-Room 309, Third Floor

Solving Response Time Variability Problems

Cluster: Scheduling
Invited Session

Chair: Jeffrey Herrmann, University of Maryland, Department of Mechanical Engineering, 2181 Martin Hall, College Park, MD, 20742, United States of America, jwh2@umd.edu

1 - The Response Time Variability Problem
Wieslaw Kubiak, Memorial University, Prince Philip Drive, St. John's, Canada, wkubiak@mun.ca

This talk introduces the Response Time Variability problem, its computational complexity, its main characteristics, and its applications.

2 - Using Hyper-heuristics for Solving the Response Time Variability Problem
Alberto Garcia-Villoria, Universitat Politecnica de Catalunya (UPC), Av. Diagonal, 647, Barcelona, 08028, Spain, alberto.garcia-villoria@upc.edu, Said Salhi, Albert Corominas, Rafael Pastor

Hyper-heuristics are a new methodology based on applying dinamically the right heuristic between a set of low level heuristics. We propose three constructive hyper-heuristics for solving a scheduling problem known as Response Time Variability Problem (RTVP). The RTVP arises whenever products or jobs need to be sequenced so as to minimise variability in the time between the instants at which they receive the resources. An experiment shows the effectiveness of the proposed hyper-heuristics.

3 - An Iterated Beam Search (IBS) Algorithm for the Response Time Variability Problem (RTVP)
Mesut Yavuz, Assistant Professor of QM & SCM, Shenandoah University, 1460 University Dr., Winchester, VA, 22601, United States of America, myavuz@su.edu

In this talk, we discuss two special cases of the RTVP, and an IBS algorithm developed for its solution. The two special cases are Single Sensor Scheduling (military ops.) and Scheduling of TV Commercials (service ops.). The TV Commercial Scheduling Problem is acyclic, i.e., it ignores the difference between the first and last execution times of a task in the planning horizon. We present our findings on this special case and discuss how IBS can be successfully adapted to solve the general RTVP.

4 - Scheduling Commercials on Broadcast Television
Srinivas Bollapragada, Principal Scientist, GE Research, 1 Research Circle, #K1-4A50A, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com, Marc Garbiras

Television networks sell advertising slots to clients by the shows on which the commercials air. They determine the exact location in the show that a commercial airs usually a few days before the airdate. There are several criteria the networks must meet in scheduling commercials. We developed and implemented an algorithm at the National Broadcasting Company to reduce sales personnel costs by automating the scheduling of commercials and to maximize customer satisfaction by minimizing errors.

5 - Using Aggregation to Reduce Response Time Variability
Jeffrey Herrmann, University of Maryland, Department of Mechanical Engineering, 2181 Martin Hall, College Park, MD, 20742, United States of America, jwh2@umd.edu

In order to generate high-quality solutions to the response time variability problem, we present an aggregation approach that combines products with the same demand, creates a sequence for the aggregated instance, and then disaggregates this solution into a feasible sequence for the original instance. Computational experiments show that using aggregation can reduce response time variability dramatically and also reduces computational effort.

■ MD59

H-Room 310, Third Floor

Tutorial: Cutting Plane, Cutting Surface, and Subgradient Methods

Cluster: Tutorials
Invited Session

Chair: John Mitchell, Professor, Rensselaer Polytechnic Institute, Department of Mathematical Sciences, 110 Eighth Street, Troy, NY, 12180, United States of America, mitchj@rpi.edu

1 - Cutting Plane, Cutting Surface, and Subgradient Methods
John Mitchell, Professor, Rensselaer Polytechnic Institute, Department of Mathematical Sciences, 110 Eighth Street, Troy, NY, 12180, United States of America, mitchj@rpi.edu

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

■ MD60

H-Room 311, Third Floor

Geometric Aspects of Optimization

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Antoine Deza, McMaster University, 1280 Main West, Hamilton, Canada, deza@mcmaster.ca

1 - Counter Example to a Conjecture on the Homotopy Path for Infeasible Interior-point Methods
Kees Roos, TU Delft, Mekelweg 4, Delft, Netherlands, C.Roos@tudelft.nl, Guoyong Gu

In a recent paper a full-Newton step infeasible algorithm was presented with its worst-case iteration complexity. This bound depends linearly on a parameter of the homotopy path, which was shown to be less than the square root of 2n. Based on extensive computational evidence it was conjectured that the parameter equals 1, which would yield a better iteration bound then for all existing infeasible interior-point algorithms. We present an example showing that the conjecture is false.

2 - Shrink-wrapping Trajectories for Linear Programming
Yuriy Zinchenko, University of Calgary, yzinchen@ucalgary.ca

Hyperbolic Programming (HP) -minimizing linear objective over an affine subspace intersected with a hyperbolicity cone- is a class of convex optimization problems containing Linear Programming (LP) and its natural relaxations. Based on these relaxations a new Shrink-Wrapping approach for LP has been proposed by Renegar. We analyze Shrink-Wrapping trajectories near a certain invariant set containing LP optimum and contrast the trajectories with the central path on some pathological LP instances.

3 - On the Primal-Dual Geometry of Level Sets in Linear and Conic Optimization
Robert Freund, Professor, MIT, Sloan School of Mgmt., E52-476, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, rfreund@mit.edu

Motivated by the regularity conditions stemming from interior-point methods, we present a geometric relationship between the primal objective function level sets and the dual objective function level sets of conic optimization problems. The geometric relationship suggests a new way to conceptualize regularity and conditioning in conic convex optimization.

4 - Computational Approaches to the Hirsch Conjecture: D(4,12)=D(5,12)=D(6,13)=7
Antoine Deza, McMaster University, 1280 Main West, Hamilton, Canada, deza@mcmaster.ca, Lars Schewe, William Hua, David Bremner

Let D(d,n) be the maximum edge diameter of a polytope defined by n inequalities in dimension d. The conjecture of Hirsch, formulated in 1957, states that D(d,n) is not greater than n-d. The conjecture relates to the worst case performance of the simplex method. The best bound known for D(d,n) is quasi-polynomial [Kalai-Kleitman 1992]. Goodey [1972] showed that D(4,10)=5 and D(5,11)=6. Recently, Bremner and Schewe proved that D(4,11)=D(6,12)=6. We show that D(4,12)=D(5,12)=D(6,13)=7.

■ MD61

H-Room 312, Third Floor

Facility Location and Network Design Models

Sponsor: Location Analysis
Sponsored Session

Chair: Lian Qi, Rutgers, The State University of New Jersey, 1 Washington Park, Room 962, Newark, United States of America, lianqi@business.rutgers.edu

1 - Optimizing the DC Locations for a Multimodal-Shipping Network with Time Window Constraints
Gang Wang, Rutgers University, Department of SCM & Marketing Sci., Rutgers Business School, United States of America, gangwang@pegasus.rutgers.edu, Lei Lei

We study the location problem for distribution centers on a multimodal shipping network where each customer has a time window to receive the delivery and the objective is to minimize the operation cost. Special cases with polynomial time solutions are analyzed, and the empirical performance of a relaxation based search algorithm is reported.

2 - A Competitive Facility Location Game with Traffic Congestion Costs
Dincer Konur, Research Assistant, University of Florida, ISE Department 303 Weil Hall, Gainesville, FL, 32611, United States of America, dincer@ufl.edu, Joseph Geunes

We study a set of competitive firms considering the location of uncapacitated facilities at a set of locations in order to serve a set of markets. Each firm incurs linear transportation, convex congestion and fixed location costs. We consider an oligopolistic Cournot game and analyze the two-stage Nash Equilibrium. Algorithms are provided to determine the equilibrium quantities for the second stage of the game. An heuristic method is stated to determine the equilibrium location decisions.

3 - Natural Gas Network Capacity Expansion Optimization Models
Qipeng Zheng, PhD Student, University of Florida, Department ISE, Weil 303, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, zqp@ufl.edu, Panos Pardalos

In this talk, generalized network flow models are proposed to solve the natural gas network capacity expansion problems. These models are on the system level, where the whole system is considered and the objective is to minimize the total cost while satisfying the system demands by finding the locations of the pipelines. Also a multistage model is proposed to deal with the long term expansion problems, which can be solved by Embedded Benders' Decomposition proposed by the authors.

4 - The Hub Center Problem with Stochastic Travel Times
Edward Hult, Cambridge University, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, e.hult@jbs.cam.ac.uk, Daniel Ralph, Houyuan Jiang

For parcel delivery companies, it is important to guarantee clients a maximum parcel delivery time, which can be modeled by the stochastic p-hub center problem. We propose an integer linear programming formulation and develop computational approaches such as the Benders decomposition for finding exact solutions. We report computational results for standard medium-sized test examples.

■ MD62

H-Room 313, Third Floor

Differing Perspectives and a Critical Review of Behavioral Ops

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu

1 - The Interaction between Competitive and Cooperative Preferences in Social Dilemma Situations in Teams

Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg, Christoph Loch, Ghufran Ahmad

In a social dilemma, each participant optimally acts according to his individual interest, but as a result, everyone is worse off. However, not everyone behaves selfishly in teams because of social preferences: individuals care not only about their own welfare, but also about that of others (positively or negatively). We investigate in experimental studies the individual effects and interactions of two known social preferences, status seeking and relationship building.

2 - Fairness and Coordination Failures in Supply Chain Contracts

Valery Pavlov, Penn State University, University Park, PA, 16802, United States of America, vpavlov@psu.edu, Elena Katok

Evidence accumulated in the laboratory experiments with supply contracts suggests that preferences for fairness are one of the key behavioral factors affecting outcomes. We generalize some previous research on contracting in a bilateral monopoly by allowing both parties to experience disutility from unfair outcomes. In our experiment, we find that whereas fairness organizes the data very well there is virtually no support for bounded rationality hypothesis.

3 - Team Familiarity, Varied Experience, and Learning

Bradley Staats, Assistant Professor, University of North Carolina at Chapel Hill, McColl Building, Chapel Hill, NC, United States of America, bstaats@unc.edu, Francesca Gino, Gary Pisano

Work in the learning curve tradition examines how increasing cumulative experience yields improved performance. Experience, however, can take many forms. Building on recent studies on learning in operations, we distinguish between the repetition of tasks and the repetition of interactions (i.e., prior experience with other team members). Using an experimental study we find that prior experience with team members has a significant and persistent effect on learning.

4 - What Should Behavioral Operations Become?

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu

Behavioral Operations is experiencing a boom of interest now. How do we know it won't prove a fad, disappearing again after 5 years? I propose some important phenomena in the context of Operations, which can fuel a high impact and unique agenda for a community.

■ MD63

H-Room 314, Third Floor

Health Care Service Delivery Design

Contributed Session

Chair: Jagpreet Chhatwal, Health Economist, Merck Research Laboratories, North Wales, PA, 19454, United States of America, jagpreet_chhatwal@merck.com

1 - Optimization of Ambulance Move up

Lei (Oddo) Zhang, The Universiity of Auckland, 70 Symonds St, Auckland, New Zealand, lzha174@aucklanduni.ac.nz

A model for relocating a single vehicle to maximize the score of getting to the next call on time will be presented. A node labeling algorithm for solving large problems will be discussed. Then a relocation model which considers a single vehicle over an infinite horizon will be presented in which state space aggregation is used to deal with large problems. Finally, a heuristic relocation model for real ambulance operations will be presented along with simulation experiments.

2 - Clinical Trial Planning and Economic Evaluation in Drug Development Using Discrete Event Simulation

Jagpreet Chhatwal, Health Economist, Merck Research Laboratories, North Wales, PA, 19454, United States of America, jagpreet_chhatwal@merck.com, Erik Dasbach

The average cost to develop a drug exceeds $800 million; clinical trials consume nearly half the cost. Computer simulation can help with the planning and design of these clinical trials, improving the efficiency of the trial's design, increasing trial's success rate, and reducing overall trial costs. We present a discrete event simulation based model to simulate a phase III clinical trial and get useful information on what data may be feasible to collect for economic evaluations.

■ MD64

H-Room 202A, Second Floor

Undergraduate Research Showcase

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, 301 Platt Blvd., Claremont, CA, 91711, United States of America, martonosi@hmc.edu

1 - The Optimal Tilt Angle of Solar Panels

Dylan Poulsen, University of Puget Sound, 2248 Wheelock Student Center, 1500 N Warner, Tacoma, WA, 98416-2248, United States of America, drspoulsen@gmail.com

If solar panels can be adjusted continuously, the optimal orientation aligns the face of the solar panel with the sun. Oftentimes, purchasing the equipment necessary for continuous adjustment is too expensive to justify the costs. Therefore less optimal adjustment schedules, such as seasonal adjustment, must be considered. In this talk we derive a model for the energy a solar panel receives daily at variable tilt angles. We then examine the costs and benefits of various adjustment schedules.

2 - On Determining the Number of Class Requests

Catie Patterson, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, catie.patterson1151@furman.edu

First-year seminars are designed to help incoming freshmen adjust to college-level material and work load. At Furman, students are asked to indicate at least five choices for seminars in which they have some interest. Here we look at the problem of determining how many choices to give students so as to ensure, with high probability, that a given percentage of students will be scheduled to a preferred class.

3 - Rethinking the Encounter Probability for Commercial Aviation Direct to Target Attacks

Garrett Howe, Virginia Commonwealth University, Nuclear Engineering, Richmond, VA, 23284, United States of America, howegl@vcu.edu, Laura McLay, Rebecca Dreiding

A nuclear attack is considered one of the most pressing terrorist threats. Our nation is particularly vulnerable to 'direct to target' terrorist attacks, which would occur before border security screening takes place. The so-called encounter probability has been proposed for evaluating border security screening operations. We propose alternative performance measures that cover flights and targets, and we analyze these performance measures using multiobjective integer programming models.

4 - Dynamic Modeling of Resource Requirements for Non-Acute Patient Care: Cornell Dynamic FMS Simulator

Michelle Castorena, Cornell University, 103 Highland Place, Apt 2, Ithaca, NY, 14850, United States of America, mc457@cornell.edu

When an emergency arises of certain types, a Federal Medical Station (FMS) is set up to assist affected locales in treating non-acute care patients. The purpose of this talk is to describe how consumable and reusable resource requirements can be estimated for a FMS throughout the duration of a campaign. We will discuss a simulation environment created to estimate these resource requirements.

5 - Disrupting Terrorist Networks

Lee Wiyninger, Harvey Mudd College, dwiyninger@hmc.edu, David Zitter, Susan E Martonosi

What makes certain types of social networks more vulnerable to communication flow disruption? In this talk, we will define a metric for measuring communication flow disruption. We will then examine how the structural properties of different classes of social networks determine the vulnerability of such networks to communication disruption when the network is modified.

■ MD75

C-Room 32A, Upper Level

Train Scheduling

Sponsor: Railroad Applications

Sponsored Session

Chair: Krishna Jha, Innovative Scheduling Systems, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States of America, krishna@innovativescheduling.com

1 - A Multi-stage, Hybrid Model for Train Schedule Optimization

Clark Cheng, Sr. Manager Operations Research, Norfolk Southern Corp., 1200 Peachtree St. NE, MS 12-117, Atlanta, GA, 30309, United States of America, Clark.Cheng@nscorp.com, Jian Liu, Edward Lin

This paper presents a multi-stage, hybrid model to optimize train routes and operating schedules at Norfolk Southern. The model is composed of a set of modules and algorithms that determine train routes, block-to-train assignments, crew assignments, locomotive balancing, and train schedules. We have used the model to develop train service plans for network design and yard rationalization studies.

2 - Implementing A Comprehensive Train Planning Model Results

Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com, Dharma Acharya, Krishna Jha

Determining a railroad's train plan is a very complex and large-scale planning problem as it involves all of its resources: railcars, crews, locomotives, yards, and tracks. We have recently performed a study of optimizing a railroad's train plan. In this presentation, we will describe what we did and how we did it. We will also share the lessons learnt in this process - what works and what does not work in practice.

3 - A Genetic Algorithm Procedure to Solve the Railway Routing and Scheduling Problem

Pavankumar Murali, University of Southern California, University Park, Los Angeles, CA, 90089, United States of America pmurali@usc.edu, Maged Dessouky, Fernando Ordonez

We present an integer programming approach to dispatch trains on routes that minimize delays. The quality of the routes and departure times from origin stations obtained by this approach are compared with the delays from a simulation model that uses a construction heuristic to dispatch trains [Lu et al. (ACM Transactions, 2004)]. We also present a genetic algorithm-based solution approach to obtain arrival and departure times at intermediate stations and to break ties during meets and overtakes.