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Preface

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Preface

In 2002 INFORMS celebrated "50 years of Operations Research". The term "50 years" refers to the founding in 1952 of the first professional society (ORSA) in the United States devoted to operations research, as well as the journal *Operations Research* later that year. (As our readers may know, ORSA merged with TIMS in 1995 to create INFORMS). It is then appropriate to say that the *TutORials in Operations Research* volume, published annually in conjunction with the annual INFORMS meeting, was conceived at a time close to the start of this second half century for operations research. This 2008 *TutORials in Operations Research* is the fifth published volume in the series.

As we continue through the early part of this second half century of OR, it is interesting to note some of the key drivers that have played a significant role in the renaissance of our field.

Cheap and ubiquitous computing. The cost of computing hardware continues to decrease at a rapid rate, while at the same time the speed of the CPU (or computing power) continues to increase at an exponential rate. The effect of these two factors has helped in different ways. As the cost of computing hardware has decreased we have moved into an *information-intensive age*. On the one hand, organizations can now routinely collect and store terabytes of data related to their operations and customers. On the other hand, the increase in computing power has made the sophisticated OR methodologies more easily available and accessible to a larger audience of practitioners.

Need for analytics. The ease of data availability has raised new challenges. In this information-rich age, to gain a competitive edge it is imperative to harness the available information and make smarter decisions. Consequently, this has brought to the forefront, at every managerial level in organizations, the need for analytical tools for better decision making.

Methodological advances and expanding range of applications. Given the historical applied nature of our profession, it should not be surprising how our profession is able to adapt and expand its boundaries to tackle modern business (e.g., operations, supply chain and logistics, revenue management, and finance) and societal problems (e.g., healthcare, bioterrorism, and education). These expanding boundaries have led to the development of new theories and models, and pushed the envelope in terms of the state of the art of our field.

The 15 tutorials in this volume collectively illustrate the state-of-the-art operations research methods and their applications to decision-making problems that arise in our current information-intensive age. The range of applications covered in this volume is broad, encompassing healthcare, supply chain management, logistics, eCommerce, and service industries. The range of methods covered is also broad including game theory, heuristics, discrete and continuous optimization, optimal learning, queuing theory, simulation, statistics, stochastic programming, and stochastic processes. We briefly provide the reader with a preview of these intriguing tutorials.

All of us have faced delays in our interactions with our healthcare delivery systems. As societies focus on improving the quality of healthcare, timeliness of healthcare is one of several key factors that have been identified as being critical to this effort. The tutorial by Linda V. Green titled "Using Operations Research to Reduce Delays for Healthcare" describes several areas in which patients routinely experience significant and potentially

dangerous delays and present OR models that have been developed to help reduce these delays, often at little or no cost.

With the increase in air travel worldwide aviation safety is an issue that concerns many travelers. In his tutorial titled "Is It Really Safe to Fly?" Arnold Barnett poses an interesting question as to how one should go about measuring aviation safety. Often, in many analytical studies, not enough attention is paid to the proper choice of measure or objective function. The tutorial carefully crafts an effective statistic to measure aviation safety. With this measure it then analyzes available data to draw conclusions on current aviation safety across the world.

Empirical research in the field of electronic commerce has been growing fast due to the availability of rich, high-quality data. eCommerce data originate from many different behavioral, social, or economic processes and interactions online, which have not always been observable or measurable in the offline world. In the tutorial titled "Statistical Challenges in eCommerce: Modeling Dynamic and Networked Data" Wolfgang Jank, Galit Shmueli, Mayukh Dass, Inbal Yahav, and Shu Zhang discuss three key aspects of eCommerce data. Each of these raises new challenges for data representation, visualization, and modeling, and they describe each of them in detail. They also present case studies that showcase the various statistical challenges associated with eCommerce data and present some solutions.

Personalization is defined as the ability to provide content and services that are tailored to individuals based on knowledge about their preferences and behavior. With the increasing use of the electronic or online medium to interact with customers, and the wide availability of data on their interactions, the interest and importance of personalization and recommender systems has grown to companies that conduct a significant portion of their business interactions online (e.g., Amazon.com, Netflix). In the tutorial titled "Personalization and Recommender Systems" Gediminas Adomavicius, Zan Huang, and Alexander Tuzhilin present an overview of the personalization field and review different types of personalization. They discuss the general personalization process and position the field of recommender systems as an integral part of this process. They then provide several directions for future research.

In the tutorial titled "Cooperative and Noncooperative Games for Capacity Planning and Scheduling" Nicholas G. Hall and Zhixin Liu provide an overview of cooperative and noncooperative games for capacity planning and scheduling decisions. In both cases, they present some basic definitions and concepts, review the recent literature, and discuss their own current research involving a combined capacity planning and scheduling problem and an auction mechanism for capacity allocation.

The management of closed-loop supply chains is becoming increasingly important as we pay more and more attention to our environment. The tutorial by Gilvan C. Souza titled "Closed-Loop Supply Chains with Remanufacturing" presents an overview of research issues and industry practices related to closed-loop supply chains with some level of remanufacturing.

Total quality management (TQM) and operational risk have received an enormous amount of attention both in the academic literature and in industry. However, these topics have been kept somewhat separate in the literature. In their tutorial titled "Total Quality Management and Operational Risk in the Service Industries" Marcelo Cruz and Michael Pinedo consider TQM and operational risk in four service industries, including transportation, healthcare, financial services, and hospitality industries, and show how TQM should be seen as part of a robust operational risk management process.

The next two tutorials focus on logistics. The tutorial "Recent Developments in Modeling and Solving the Split Delivery Vehicle Routing Problem" by Damon Gulczynski, Bruce Golden, and Edward Wasil describes the split delivery vehicle routing problem. In this problem, a customer's demand can be split among several vehicles. In this tutorial, the authors summarize the recent literature on the split delivery vehicle routing problem, describe solution procedures and results of computational experiments, and suggest directions for future research.

City logistics aims at reducing some of the negative factors associated with freight transportation in urban areas while at the same time supporting the economic and social development of the cities. The fundamental idea is to view individual stakeholders and decisions as components of a complex and integrated logistics system. The tutorial titled "City Logistics" by Teodor Gabriel Crainic presents an overview of city logistics concepts. It also attempts to identify interesting research avenues and challenges.

The next five tutorials have a greater focus on operations research methodologies. The tutorial by Warren B. Powell and Peter Frazier titled "Optimal Learning" addresses the problem of efficiently collecting information with which to make decisions. Optimal learning is different from stochastic optimization. This tutorial provides an introduction to optimal learning, covering important dimensions of a learning problem and introducing a range of policies for collecting information.

"Simulation and Optimization" by Chun-Hung Chen, Michael C. Fu, and Leyuan Shi gives an introduction of the research in the area of simulation optimization. Simulation optimization deals with the problem of optimizing a performance function from a simulation model. The authors introduce different types of problems, and provide an overview of the major approaches in this area. They then give a more in-depth presentation of three specific methods: efficient simulation budget allocation, stochastic gradient estimation, and the nested partitions method.

Chance-constrained stochastic programs have various applications in reliability and risk management. However, most chance-constrained stochastic programs are computationally intractable. In the tutorial titled "Solving Chance-Constrained Stochastic Programs via Sampling and Integer Programming" Shabbir Ahmed and Alexander Shapiro discuss an approach based on solving approximating problems using Monte Carlo samples of the random data.

In the tutorial "Value-at-Risk vs. Conditional Value-at-Risk in Risk Management and Optimization" Sergey Sarykalin, Gaia Serraino, and Stan Uryasev present their experience working with the popular risk measures value-at-risk (VaR) and conditional value-at-risk (CVaR). They describe the pros and cons of these risk measures and illustrate them with several examples. They also show how to use VaR and CVaR in optimization settings through some case studies.

GRASP, or greedy randomized adaptive search procedure, is a powerful metaheuristic technique that repeatedly applies local search starting from solutions constructed by a randomized greedy algorithm. It is extremely useful in solving hard discrete optimization problems that occur in practice. In the tutorial titled "Metaheuristic Hybridization with Greedy Randomized Adaptive Search Procedures" Mauricio G. C. Resende considers ways to improve GRASP by hybridization techniques. The idea behind the hybridization of GRASP is to effectively combine ideas or methods from other heuristic procedures together with GRASP to create new and more effective heuristic procedures.

The last tutorial describes a major educational initiative to make the applied operations research philosophy and operations research methodologies accessible to high school students. In the tutorial titled "Project MINDSET: High School Mathematics and Operations Research" Kenneth Chelst, Thomas Edwards, Robert Young, Karen Keane, and David Royster describe an exciting new NSF funded project and its associated challenges to develop, implement, and evaluate a two-semester course for high school seniors based on the mathematics of operations research and industrial engineering.

We hope you will find this collection of 15 tutorials enjoyable, eye-opening, and rewarding. We have certainly enjoyed the privilege of putting this collection together!

Zhi-Long Chen and S. Raghavan
University of Maryland,
College Park, Maryland