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Book Reviews

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Book Reviews

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In *Book Reviews*, we review an extensive and diverse range of books. They cover theory and applications in operations research, statistics, management science, econometrics, mathematics, computers, and information systems. In addition, we include books in other fields that emphasize technical applications. The editor will be pleased to receive an email from those willing to review a book, with an indication of specific areas of interest. If you are aware of a specific book that you would like to review, or that you think should be reviewed, please contact the editor.

The following books are reviewed in this issue of *Interfaces*, 44(5), September–October 2014: *Analytics for Managers With Excel*, Peter C. Bell and Gregory S. Zaric; *Fair Revenue Sharing Mechanisms for Strategic Passenger Airline Alliances*, Demet Çetiner; *Applied Stochastic Processes*, Ming Liao; and *Hybrid Metaheuristics*, El-Ghazali Talbi.

BELL, PETER C., GREGORY S. ZARIC. 2013. *Analytics for Managers With Excel*. Routledge, 322 pp. \$59.95.

Finding a book that can serve as both a functional textbook and a guide for the business practitioner is challenging. In the introduction to *Analytics for Managers With Excel*, the authors state that their objective is to provide material for the manager of the future. They have succeeded in this goal by writing a good textbook for teaching how Excel can aid in pulling together and using analytic data. The book is structured so that it takes the reader step-by-step through modeling, decision making, and securing a competitive advantage with analytics. It also includes many explanations on how to use Excel to organize the information needed to model and make decisions.

This book would be valuable to the business practitioner working at a small company that cannot afford to hire data analysts; it would give this business manager the necessary details for obtaining and using Excel data. Conversely, a manager at a mid-size or large company that has data analysts would find it cumbersome to search through the step-by-step Excel keystrokes to find the concepts needed for modeling and decision making. The authors state they believe that managers should understand how information is derived. Although this may be true for framework assumptions, a manager in a larger organization does not need to know how to use Excel to analyze data.

The book has several positive features. One of its best features is how it takes the reader through the logic of making a decision on a problem, and then discusses how to use Excel to set up the analysis needed. It includes several examples in which it details a case and takes the student through all the steps required to solve the problem. One finds oneself wishing the authors did more of this in each chapter. They give many good, short examples of companies that used the strategy discussed; however, the more in-depth examples are the real gems. At the end of each chapter, the book also recommends cases for further application of the concepts. Unfortunately, these cases can sometimes be difficult or expensive for the student or business practitioner to procure.

The last two chapters are particularly outstanding for business managers, especially large-company managers who have analysts to run the data for them. These chapters have no Excel minutiae, just good, solid business concepts. If the authors ever decide to write a business book for the practitioner, they could model that book on these chapters and put all the Excel functionality into an appendix. They would then have a solid business book similar to *Naked Statistics* (Wheelan 2013).

This book's biggest stumbling block is in the area of presenting data to management, a topic that is extremely important to students and managers—its value cannot be understated. If analysts cannot deliver

the results of their analyses to management, all their hard work will be for naught. This topic justifies a full chapter; however, the authors mention it only in the addendum to Chapter 4. In this addendum, they give some fine examples of poor charts and graphs. Unfortunately, they do not give any examples of good charts and graphs; they give only a list of what makes a good graph. A few visuals of good graphs, such as in *Understanding Variation* (Wheeler 2000), would have been very helpful. Instructions on how to make graphs and charts in Excel are also missing.

In conclusion, I recommend this book for instructors who are looking for a textbook that combines the principles of analytics with the functionality of Excel. They will be able to use it to teach their students the necessary analytic concepts and how to leverage Excel to expand on the capabilities of their data. I also recommend it to readers who want to learn how to maximize the use of Excel for their analytics needs. However, it is a bit too focused on Excel functionality to be useful to the working manager who is looking to apply the data from the analytics department.

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ÇETINER, DEMET. 2012. *Fair Revenue Sharing Mechanisms for Strategic Passenger Airline Alliances*. Springer-Verlag, 168 pp. \$99.00.

Most travelers today are familiar with at least one of the three largest passenger airline alliances, namely Star Alliance, SkyTeam, and Oneworld. Their founding at the end of the 1990s was an important step in helping the carriers involved increase their efficiency and expand their markets, despite legal and political restrictions on mergers or takeovers among airlines. To make such an alliance work, however, a number of difficult operational problems must be solved. One is the question of how to allocate revenues received from passengers on interline flights (i.e., flights operated by more than one airline) among the operating carriers.

The allocation should be fair in the sense that no alliance member would be better off by not being a part of the alliance.

This question of fairness lies at the heart of the book, which is based on the author's PhD thesis. He uses concepts from game theory to determine such a fair allocation, assuming a centralized revenue allocation that seeks to maximize the revenues of the alliance as a whole. Given that such centralized control is not realistic, the author suggests using this solution as a benchmark to evaluate the fairness of several revenue-allocation heuristics that are similar to those found in practice.

The book has nine chapters. Chapters 1–4 include a general introduction to basic revenue-management concepts, some background on strategic passenger airline alliances, and an introduction to cooperative game theory. These chapters are helpful to readers not familiar with these topics and comprise an easily understandable overview of the important concepts and modeling approaches that are used in the main part of the book, Chapters 5–8.

The methods presented in Chapters 5 and 6 have been published elsewhere (Kimms and Çetiner 2012); they focus on how to use the game theoretic concept of a so-called nucleolus to calculate fair revenue allocations under the assumption of centralized control. The author shows that this allocation can be computed for relatively large networks by using a deterministic model.

In Chapters 7 and 8, the author then uses this nucleolus method as a benchmark to investigate the fairness of three heuristic revenue-sharing mechanisms under decentralized control; these mechanisms are revenue proration (1) based on distances flown, (2) based on the local fares associated with individual flight legs in the same fare class of an interline flight, and (3) proportional to expected leg demand. He uses a small simulation study to evaluate the fairness of these heuristics, and determines that the proration based on local fares is the best mechanism. Motivated by this result, the local-fare heuristic is further enriched by including dual information from the linear programs that each airline solves to determine airline seat allocations in an attempt to reduce discrepancies among the decisions the airlines make separately for interline flights. Çetiner and Kimms (2013) have published the results from

these two chapters. Chapter 9 concludes the book with a brief summary.

Overall, I think the book is well-written, self-contained, and would be of interest to academics working in this area. Readers already familiar with Kimms and Çetiner (2012) and Çetiner and Kimms (2013) will not find significant additional material in the book; however, others may find it an attractive read because it brings together the theoretical (centralized) allocation approach with the heuristics for the decentralized case, and more substantial background material than allowed, given the space restrictions of journal articles.

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LIAO, MING. 2014. *Applied Stochastic Processes*. Chapman and Hall, CRC Press, 199 pp. \$79.95.

The author presents a precise and concise account of applied stochastic processes suitable for a first-year graduate course that emphasizes applications and computations; however, he also addresses the development of a complete mathematical theory. I teach a graduate stochastic processes course to industrial engineering and operations research students. This course is a combination of stochastic theory and stochastic modeling and applications; therefore, I use Kulkarni (2010) as a textbook.

It is obvious from the outset that this book is intended for graduate students in a mathematics and statistics program. Thus, a background in measure theory and stochastic differential equations is necessary to truly understand the depth of the presentation. Overall, the book is written for readers with a very sophisticated level of understanding of the topic.

The volume comprises six chapters and has a structure that is fairly standard in many similar books. Ross (1983), for example, is similar in organization, detailed development, and content level.

The introductory chapter, *Probability and Stochastic Processes*, summarizes the basic concepts and facts with

little explanation and few proofs. Readers who do not have a background in measure theory, Borel σ -algebra, and Lebesgue integration may understand the general concepts, but not the depth of the concepts throughout the text. For example, the detailed reference text the author recommends to accompany his presentation is Billingsley (1986). The chapter covers the basic definitions of probability, random variables, mathematical expectation, joint distributions and independence, convergence of random variables, Laplace transforms, and generating functions. Examples are given of continuous and discrete random variables, definition and classification of stochastic processes, stopping times, and conditional probability and expectations. A few examples include solved solutions, which are good. On page 17, the author presents a MATLAB method of simulating an exponential random variable; however, he gives no real explanations of why one would want to do that, or of what the result should look like from the random numbers generated by the computer program when compared to the probability distribution function of the exact solution. How accurate is MATLAB?

In Chapter 2, he covers the essence of Poisson processes in 15 pages, including their derivation, the exponential interarrival times property, conditional distribution of arrival times, Poisson processes with different types of events, compound Poisson processes, and nonhomogeneous Poisson processes, and scatters a number of excellent examples within these pages. This is quite a feat.

In the first few sections of Chapter 3, the author introduces renewal processes, the elementary renewal theorem, renewal reward processes, and queuing systems. In subsequent sections, he discusses the renewal equation, the key renewal theorem, and regenerative processes. Finally, in the last section of the chapter, he introduces the queue-length distribution and Poisson arrivals see time averages (PASTA). Introducing queuing systems within the chapter on renewal processes is clever and unique. Most authors relegate queuing systems to a separate chapter after continuous-time Markov chains. Consequently, the academic level of Chapter 3 is very high. Again, as mentioned in discussing the use of simulation in Chapter 1, the author includes a simulation of a queuing system with the output from MATLAB; however, he does not include

the MATLAB script that would enable the reader to understand how the output was generated.

In the 35 succinct pages of Chapter 4, the author covers most of the details of discrete-time Markov chains (DTMCs). Starting with the Markov property and the strong Markov property, he provides some examples of Markov chains, the Chapman-Kolmogorov equations, hitting times, and reaching probabilities. This chapter is coherent and well written, although it does not include familiar transition diagrams with nodes and arrows; instead, it has the numbered states in parentheses ($\bullet$) and LaTeX forward, curvilinear, and backward arcs, which are carried out from a category theory perspective. A simple random walk with reflecting boundaries at states $\{0, N\}$ appears as:

$$(0) \xrightarrow{1} \xleftarrow{q} (1) \xrightarrow{p} \xleftarrow{q} (2) \xrightarrow{p} \cdots \xleftarrow{q} (N-1) \xrightarrow{p} \xleftarrow{1} (N).$$

In my view, this graphic, especially with its colliding arrows, does not add measurably to one's understanding of a simple random walk.

The author then covers the class properties of DTMCs, recurrence and transience. Finally, he covers first-passage times, branching processes, DTMC stationary distributions, and limiting probabilities. He explains each with simple examples, some of which he does cleverly; for example, he demonstrates the computation of a first-passage time probability with MATLAB after carefully explaining why it works. Most textbooks do not explain the matrix calculation approach to these first-passage time probability calculations, which can be very complex if matrix algebra is not used.

Similar to the DTMC chapter, the chapter on continuous-time Markov chains (CTMCs) is written competently. As he does in Chapter 3, the author discusses queuing theory, including a description of the Markovian aspects of queuing theory (e.g. M/M/1, M/M/k).

The first four sections of the final chapter deal with the basics of Brownian motion (BM), its fundamental properties, reflected BM, stopping times, conditional expectation and martingale times, BM with drift, and geometric BM. The last three sections deal with stochastic integrals, Ito's formula, and a simple stock-market model. The level of this chapter is again academically very high; therefore, the reader who is unfamiliar with measure theory and stochastic differential equations

(SDE) may not appreciate the information it includes. The author does not really explain the Black-Scholes formula, which I find surprising; and he includes no meaningful calculations with the formula. I would have liked to see MATLAB utilized in this chapter to illustrate some of the computations with SDE, because MATLAB is useful in this domain.

The book is efficient in its presentation; it has few graphics or tables, and a minimal number of functional graphs. It should appeal to an audience that has a sophisticated mathematical background. Its most formidable competitor is Ross (1983). A decided advantage of this book over Ross' book is the price; Liao's book is approximately half the price. Many of the examples in the Ross book are also in the Liao book, often with minor modifications or extensions. However, I note that Ross wrote his book 30 years ago; we should expect a book written today to have improvements in content and presentation rather than Ross' book to be made more compact.

The author clearly wanted to minimize the use of illustrations. The entire text has only six MATLAB-generated figures. One might argue that because this is a mathematics text, illustrations are unnecessary. However, many concepts in stochastic processes, especially for students first learning them from a textbook, could be clarified by using (1) meaningful probability transition diagrams in DTMCs and CTMCs, or sample paths of renewal and counting processes that clearly show the critical relationship among the event and interevent random variables of the process, and (2) rate-out = rate-in diagrams in queuing models, which are useful for building the steady-state equations of queuing processes.

The computer demonstrations are not developed as extensively and with the same level of depth as the mathematics in the book; they are more of an afterthought. This is unfortunate, because the book lacks the availability and power of MATLAB and other computer languages (e.g., Maple and Mathematica) to illustrate many of the concepts discussed. Conversely, this lack offers the instructor the opportunity to add his (her) own applications and examples.

In summary, I am somewhat disappointed in this volume because it does not live up to its title. It will not replace my choice of Kulkarni (2010) for teaching stochastic processes.

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TALBI, EL-GHAZALI, ed. 2013. *Hybrid Metaheuristics*. Springer, 456 pp. \$217.55.

The family of metaheuristic procedures was traditionally designed to solve very complex problems and was typically inspired by nature (Yang 2010). The process of metaheuristics design usually takes time (even years) and requires extensive validation and verification. The metaheuristics concept, which was created by Fred Glover in 1986 (Gendreau and Potvin 2010), has been applied in the resolution of hundreds of optimization problems in real companies and complicated situations. After the development of metaheuristic algorithms in the last decade of the 20th century and having shown their validity to solve a myriad of practical problems, it is now time to find new families of algorithms that follow the same source of inspiration but enrich their performance and type of results. This has been the main purpose of the hybridization of the metaheuristics. Hybridization is not only the mere juxtaposition of metaheuristic techniques; it is also an enhancement of the formulation of metaheuristics to find more accurate methods to solve problems in combinatorial optimization. Hybridizing methodologies are an emerging trend in the research literature (Blum et al. 2010, Montoya-Torres et al. 2011).

This book provides a discussion of state-of-the-art hybrid metaheuristics; thus, it helps its readers build and put into practice hybrid metaheuristics to solve complex optimization problems (e.g., continuous versus discrete, mono-objective versus multiobjective, uncertain models versus deterministic models) in a diverse group of application areas. It has a companion book (Talbi 2009), which addresses the basics of metaheuristic algorithms and that I reviewed for *Interfaces* (Rand 2012). Although the present book is an edited work containing contributions of well-known experts in the area, the previous reference is an introduction to the

topic of metaheuristics; as such, it can be helpful in teaching graduate and PhD students.

Hybrid Metaheuristics has 17 chapters arranged in five parts:

Part I: *Hybrid Metaheuristics for Mono and Multi-objective Optimization and Optimization Under Uncertainty* (Chapters 1–3),

Part II: *Combining Metaheuristics with (Complementary) Metaheuristics* (Chapters 4–9),

Part III: *Combining Metaheuristics with Exact Methods from Mathematical Programming Approaches* (Chapters 10–14),

Part IV: *Combining Metaheuristics with Constraint Programming Approaches* (Chapter 15), and

Part V: *Combining Metaheuristics with Machine Learning and Data Mining Techniques* (Chapters 16 and 17).

Because this is an edited book, with each chapter written by a different contributor, the reader can read each chapter independently. *Hybrid Metaheuristics* is an excellent manuscript for a reader who wants to understand state-of-the-art hybrid metaheuristics and their applications. One of its main contributions is the clarity of its explanations about quickly and efficiently solving large-scale problems in a diverse range of applications in companies in different sectors, including telecommunication, bioinformatics, computer science, logistics and transportation, and scheduling.

In Chapter 1, Talbi presents a taxonomy of hybrid metaheuristics with detailed descriptions of methods of hybridizations and main areas of applications. Chapter 2 describes the use of hybrid metaheuristics for the dynamic and stochastic vehicle routing problem. The third chapter is devoted to the combination of metaheuristics for solving multiobjective combinatorial optimization problems, when no information about the decision maker's preferences is available.

Part II begins with chapters on hybridizing cellular genetic algorithms with active components of bio-inspired procedures and mixing GRASP and path-relinking methods. Chapter 6 describes hybrid metaheuristics for the graph partitioning problem, and Chapter 7 introduces hybrid methods for medical data classification. Chapter 8 is devoted to the explanation of HydroCM or hybrid parallel search models for heterogeneous hardware environments. Part II concludes with Chapter 9, which presents a multithread

GRASP_xELS for the heterogeneous capacitated vehicle routing problem.

Part III discusses the combination of metaheuristics and exact methods in mathematical programming. It covers the heuristic side of the mixed-integer programming solvers, the combination of column generation with metaheuristics, an application of large neighborhood search to strategic supply chain management in the chemical industry, VNS-based heuristics for feature selection in data mining, and scheduling English football fixtures.

Part IV, Chapter 15, is dedicated to a multiparadigm tool for large neighborhood search, and Part V includes a study about the metaheuristic performance on graph coloring problems using data mining and metaheuristic search to reinforce learning.

The intended audience for *Hybrid Metaheuristics* encompasses professors, practitioners, PhD and graduate students, computer experts, and research and development personnel in a wide range of specialties, including operations research, computer science, management science, business analytics, health management, civil engineering, and marketing.

I think this book could be a source of inspiration for those looking for new procedures for hybridizing metaheuristics and new application areas for metaheuristic techniques. Correspondingly, some chapters could help PhD students find innovative ways to improve other metaheuristics to solve new problems. Furthermore, the first chapter, which includes a taxonomy of hybrid metaheuristics, could be useful in teaching the background

of metaheuristics hybridization in master's or doctoral degree programs. Moreover, each chapter presents a very rich list of updated references, thus enhancing the book's value for researchers and practitioners. Finally, I recommend using this book with its companion (Talbi 2009). Reading both books at the same time can produce interesting synergies to help a reader understand the innovative concepts presented.

In conclusion, I consider *Hybrid Metaheuristics* to be a good reference for researchers, practitioners, and students of operations research or computer science who want to have a complete view of metaheuristics and the process of obtaining new procedures by hybridization.

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